

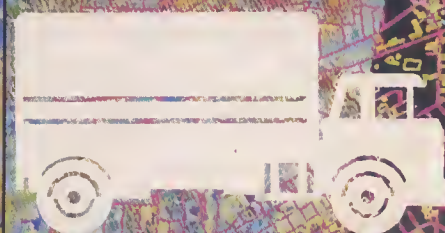
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# HIGH TECHNOLOGY BUSINESS

DECEMBER 1988

US \$5.00/CANADA \$6.00/UK £2.75

## SMART MAPS: ROUTE TO BILLION-DOLLAR SAVINGS



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0 88426

in Licensing Patents  
the High-Tech Field



# THE BUS STOPS HERE!

## CompuStar: PS/2 and PC/AT Compatibility.

Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT\* bus is your best buy but, then again, the new PS/2\* bus may become the next industry standard." Great advice, right? If trying to decide on a microprocessor weren't tough enough, now you're expected to pick a bus, too.

### RELAX, NOW THERE'S COMPUSTAR®.

The all new CompuStar from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or... both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the *wrong* computer system!

### FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to 16 megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. *Nobody* but Wells American gives you this kind of value.

### A CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use *both* buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Depending on configuration, the CompuStar can have up to 13 bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT and PS/2 slots. No matter which bus becomes the next industry "standard," you'll have peace of mind knowing your investment in a CompuStar will be protected.

The CompuStar is also easily expanded. That's because there are seven CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that will leave *more* room on your desktop than any of the so-called "desktop" models.

### A NEW IDEA FROM AN OLD COMPANY.

The CompuStar® Multi-Processor, Convertible Bus™ Microcomputer. It's no surprise that our engineers invented it. After all, we've been making microcomputers longer than anyone else... even longer than IBM! And if that kind of experience doesn't impress you, CompuStar's service programs surely will. You can select an optional overnight module swap-out plan or on-site service from General Electric Corporation — one of the most respected names in consumer electronics. And, of course, every CompuStar carries a full one-year factory warranty.

### FINALLY, AFFORDABLE TECHNOLOGY.

Think all this technology sounds expensive? It's not. CompuStar 20MHz 80286 systems start as low as \$1995†. There are also inexpensive 8086 and powerhouse 25MHz 80386 systems available. Plus, there is a wide variety of CompuStar display, tape and disk options including a one gigabyte erasable optical disk. You can choose a factory pre-configured CompuStar or custom design one yourself. Just unlock the

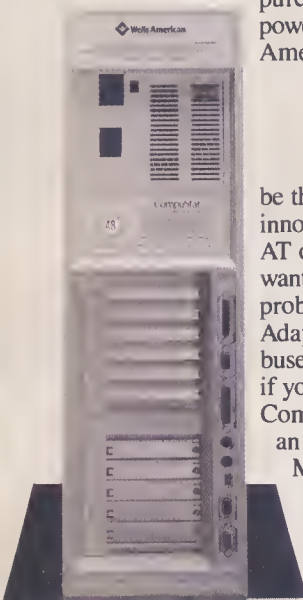
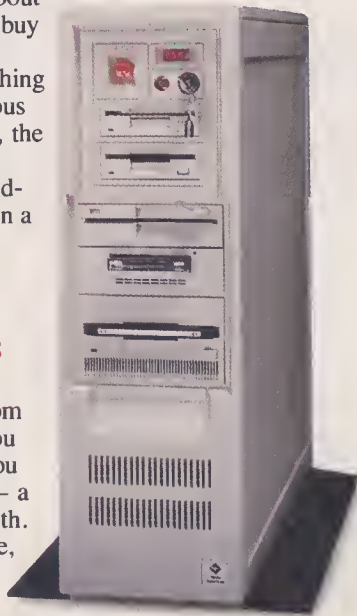
front panel and literally "snap-in" a bus, CPU, memory or disk module in a matter of seconds. It's system flexibility never before available... at any price.

While one of our competitors (we won't mention any names) threatens you with "missing the bus," most simply *pass* the bus. Our new CompuStar, however, *eliminates* the bus problem altogether. Not to mention the processor problem. Even the expansion problem. Prove it to yourself. Call today about our 31-day trial offer. Oh, and by the way, the next time anyone asks, tell 'em you know where the bus stops.



**Wells American**

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\*Personal Computer, AT, AT and PS/2 are trademarks of International Business Machines Corporation. †Photographs depict optional equipment. A complete price list is available upon request. CompuStar 80286 system (\$1995) includes an AT Bus Module, built-in VGA/EGA display adapter, one diskette drive with controller, two serial/one parallel/one mouse port, keyboard and 220 watt power supply.

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keep his  
name alive,  
who will?**



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### Keep the Dream Alive

The Statue of Liberty-Ellis Island Foundation, Inc. is a charitable corporation to which contributions are tax-deductible to the extent allowed by law. A copy of the last financial report filed with the Department of State may be obtained by writing to: New York State, Department of State, Office of Charities Regulation, Albany, New York 12231, or The Statue of Liberty-Ellis Island Foundation, Inc., 52 Vanderbilt Avenue, New York, New York 10017-3808. Photo courtesy of California Museum of Photography, University of California, Riverside.



DECEMBER 1988

Cover symbols by Everett Davidson

## CONTENTS

VOL. 8, NO. 12

# HIGH TECHNOLOGY BUSINESS

## FEATURES

20

**SMART MAPS: ROUTE TO BILLION-DOLLAR SAVINGS** Using digital maps, businesses can route their vehicles, choose prime retail locations and determine if hazardous materials are at a site chosen for a facility.

16

**BIRTH-CONTROL: FERTILE HIGH-TECH BUSINESS** Only minuscule amounts are being spent worldwide on R&D for birth control. But, progress is being made in clever ways to control overpopulation, one of the world's great problems.

26

**TAPPING INTO UNIVERSITY TECHNOLOGY** A follow-up to last month's "Profiting from University Research," this article explores ways to capitalize on innovative research.

## COLUMNS

10

**JAPAN WATCH** One brilliant innovator is working on a computer that reacts to users' facial expressions.

12

**BOOKS** A down-to-earth review of three books designed to help upgrade written communications, including advertising.

14

**THE LAW** Timing the filing for a patent is significant, especially if the patent will help a competitor.

## MARKETWATCH

41

**NEW COMPANIES** New high-tech operations, their purposes and how they were funded.

41

**CONTRACTS AWARDED** Who gained and awarded them and how much.

43

**RESEARCH REPORTS** Projections on important niche markets plus discussions of new technology.

45

**ACQUISITIONS** Who absorbed whom and for how much.

45

**JOINT VENTURES** Who is getting involved in deals with whom and why.

## DEPARTMENTS

3

**EDITOR'S NOTE**

4

**LETTERS**

6

**NEW DEVELOPMENTS** Inexpensive, portable projectors based on LCDs; new findings on causes of vision problems for VDT operators; a new bonding material for teeth; an add-on for power meters that helps avoid brownouts.

46

**NEW PRODUCTS** for the office, factory and executive vehicles.

48

**PERSONAL TECHNOLOGY** Will a pocket time-and-information manager popular in Japan make it in the States?

30

**NEWSLETTER DIGEST** Excerpts from newsletters covering the latest in technological developments.



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# The Limitations Of Technology

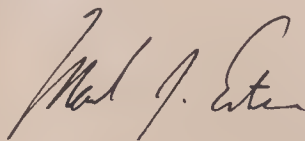
In an age as aggressively secular as ours, it is scarcely surprising that hopes for a *deus ex machina* to solve apparently insurmountable problems have turned into hopes for something like a "*machina ex machina*." We now look to technology to save us from ourselves, even as, Janus-like, we look askance at it at the same time.

Some articles this month show what high technology can accomplish, and what it cannot. On the plus side, our cover story, "Smart Maps: New Route to Profits," on page 20, showcases a technology that might at first seem of limited applicability—digital mapping—but that actually has implications for just about every industry that moves goods or people, needs to find optimum sites to locate facilities, or wants the best available information on effective marketing of products or services.

On the other hand, our story on the role of high technology in birth control, "Birth Control: Fertile High-Tech Business," on page 16, indicates the inherent limitations of technological approaches to human problems.

The scientists seeking better ways to allow people to determine when and if they have children do their daily work in a research environment relatively free of the social pressures that confront modern women who choose to use birth control. Yet, as human beings, the researchers live in a world in which certain major religious teachings oppose any form of birth control and population explosions in nations that cannot afford modern technology bode ill for the future of an interconnected world economy in which, for better or worse, we are our brothers' (and sisters') keepers.

High-tech birth-control methods will make contraception simpler for the people most committed to it and best able to afford it already—while leaving wider issues to be resolved by sociologists, religious leaders and, alas, politicians. Technological change has outpaced social adaptation. And it does not seem likely that technology will save us from ourselves, any more than religion has so far managed to do. An effective alliance between the secular and the sacred seems no closer as we approach the start of the second millenium A.D. than it was when the secular Romans threw Christians to the lions—or the later, ascendant Christians burned the library at Alexandria. But as Christmas approaches, it is a good time to remember that this is a season of hope: We continue to learn so much about our world that perhaps, in years to come, we will understand an equal amount about ourselves.



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**HIGH TECHNOLOGY  
 BUSINESS**



## ■ Good Idea Zapped

THE ARTICLE, "It Seemed Like a Good Idea at the Time," by Herb Brody in your October issue, mentions that food irradiation's major problem is one of image, and that the food industry's indifference comes from the word "radiation." He told only half the story.

The truth is that irradiation changes the molecular composition of food in unpredictable ways. The changes are toxic to humans in that they give the body unpredictable molecules that are difficult to assimilate. Irradiation very quickly sends the body's various chemical factories, such as the liver and hormone glands, berserk.

Food companies are avoiding mention of irradiation like the plague because if they started using it, an immense outcry would arise from health-conscious Americans. That is also why there is an effort to get the Food & Drug Administration to allow an attempted cover-up by reducing the food-labeling requirements.

Please correct this error in your reporting. Like the broadcast media, you have a responsibility to give equal attention to both sides of an issue.

*Dennis Denlinger  
Carmichael, California*

## ■ Market Research Revisited

WE WHOLEHEARTEDLY agree with "Sorry, Wrong Number" in your September issue. Traditional market-research firms routinely mispredict the course of technology businesses by basing their research, analysis and forecasts on the vendors' component/box counts. Past and existing market conditions, competitive environments, and technology requirements are not constants—especially in the information-processing industry.

Business Research Group provides strategic planning information for technology vendors. We realized that in this increasingly competitive market, simple box-counting no longer meets their needs. To compete effectively, primary research—demand-side survey and analysis—is required to give vendors a detailed understanding of customers'

business and technological environments.

*Donna Ruane  
Marketing Communications  
Manager  
Business Research Group  
Boston, Massachusetts*

## ■ Exaggerated Claims

IN RESPONSE TO "Success Story: Insuring," in the October issue, the United Service Automobile Association's automated system did not expedite my claim with its Reston, Va., office.

A tree fell on my home on July 26, 1988. As of September 1, reconstruction had not yet begun. USAA had various excuses for the delays: 'The file is being reviewed'; 'The supervisor must come to the home and reinspect,' etc.

I made 19 calls to USAA regarding this claim; USAA responded by providing a few status reports.

No reconstruction work started until September 19th.

*T. Lloyd Johnson  
Arlington, Virginia*

## ■ Saved by the Digest

I ALMOST CANCELED my subscription when you shifted your focus from high technology to high-tech business. The primary reason I subscribed was to keep up with high-tech research and development (from a layman's perspective). I am in a high-tech business (computer software) and get enough business information from other sources. I am now very happy to see your inclusion of reports from various high-tech newsletters and journals. This is precisely the kind of broad-range digest of information I want.

*Fred Tuck  
Vice President  
Product Development  
Lancraft  
Norcross, Georgia*

## ■ Missed the Party

IN READING THE October article "Who's Better for High Tech?" I was distressed to notice the lack of Libertarian candidate for president, Ron Paul, in your comparisons. Paul, a former

four-term congressman from Texas, is running a full-time earnest campaign for the presidency and I believe would have been an interesting addition to your article. I hope that in the future you will consider including him and the Libertarian Party in your articles. People with an interest in high technology are favorably inclined toward a libertarian viewpoint; discussing our candidate should complement that interest.

*Thane Lee Eichenauer  
Tempe, Arizona*

**Editor's note:** *The percentage of our readers "favorably inclined toward a libertarian viewpoint" is most likely no greater than that of the populace in general.*

## ■ Hints from Harvard

"OUT, OUT, DAMNED SPOT" (August) illustrates a reason for the increasing costs of medical care. I doubt that the \$19,500 machine described ever approaches the effectiveness of the 90-second scrub and a squirt of lubricating germicide.

Dogma traps surgeons to the 10-minute scrub and ignorance restricts them to the use of short-lived germicide, when a sterile chemical film on their hands could serve as the primary glove!

*Carl W. Walter, M.D.  
Harvard Medical School  
Boston, Massachusetts*

## ■ Rotary Research

REGARDING THE ARTICLE "It Seemed Like a Good Idea at the Time" (October), the section on rotary engines reflects poor research. Despite early problems with the rotary engine, Mazda continued to sell and improve it for years up to the present. I have come to expect better attention to accuracy than this in *High Technology Business*.

*John Fobian  
Springfield, Virginia*

We welcome comments from our readers. Address letters to Editor, HIGH TECHNOLOGY BUSINESS, 270 Lafayette Street, Suite 705, New York, NY 10012. We reserve the right to edit letters for length and clarity.

# WALL STREET JOURNAL

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It's News—

Factory Shipments

In billions

Labor

A Special Report  
And Their  
Fields

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work gains in power  
The practice has  
from workers, says  
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# New Developments

*Issues, products*

*and advances*

*that help create*

*new opportunities*

*for high-tech*

*businesses*

## Less Filling, Bonds Great

**A** NEW BRUSH-ON, tooth-colored covering that bonds permanently to silver fillings should make people with a mouth full of silver smile. Cover Up, jointly developed by the Parkell Biomaterials Division and Sun Medical of Mitsui Petrochemical, lets dentists mask silver fillings with a natural-looking veneer, without drilling, in only 15 minutes.

The nonmetallic composite of glass and porcelain in an epoxy base may have health benefits as well as cosmetic ones, according to Parkell. Parkell's director of research, Dr. Nelson J. Gendusa, said Cover Up stops mercury vapor from escaping from silver fillings when a person chews. Mercury, a toxic metal, accumulates in the body and can cause memory loss, nervous disorders, blindness and death. However, Dr. P.L. Fan of the American Dental Association said that mercury escapes from fillings in such small amounts that it does not constitute a health problem. "Most people encounter more mercury in everyday activities, such as eating fish," said Fan.

Cover Up has advantages over other nonmetallic tooth fillers, which require drilling and can shrink away from the tooth wall as they harden, forming cracks that can trap bacteria and lead to sec-

ondary decay. It also may be a substitute for the most common and expensive cosmetic replacement, porcelain crowns. Crowning requires

multiple trips to the dentist and costs hundreds of dollars per tooth; Cover Up is applied in a single, 15-minute visit. —*Alexandra Biesada*

## New Projectors Based on LCDs

**E**NLARGING the output of computers and VCRs is now much simpler. Kodak and DuKane have each introduced new projectors, based on liquid-crystal displays, that enable large groups to observe what was created on the face of cathode-ray tubes.

The portable Kodak LC500 Video Projector can reproduce what appears on a color monitor or color TV. At \$3,500, it costs about half as

much as older model color projectors and, at 13 pounds, it weighs about an eighth as much.

The Magnaview 400 from DuKane Corporation adds 64 shades—16 at a time—of differentiating color to projected displays taken from monochrome microcomputer monitors. It's not the first to do this, but it offers many more shades than Telex's Magnabyte. The DuKane device, which lists for \$1,495, obtains its necessary light from the transmissive overhead projector it is designed



DuKane's Magnaview 400 in use. Sitting on an overhead projector, it adds colors to monochrome displays for greater clarity.

- Presentation-quality color projections from crt images
- Study eyes VDTs
- "Intelligent registers" could power-down bills





The portable LC500 Video Projector from Kodak is lightweight and easy to use.

to lie on (see photo above); the Kodak projector has a built-in light source.

Besides low cost and portability, Kodak claims ease of use for its color projector. The lawnmower-sized projectors it replaces are often difficult to adjust. Kodak also says the LC500 is no more difficult to operate than a projector for 35mm transparencies, which it resembles.

DuKane's projector is also as simple to operate as other screen projectors and, at 3.5 pounds, weighs less than most of the others. Kodak introduced the first commercial monochrome screen projector, the Datashow, in 1986. Datashow has been copied by over a dozen manufacturers and prices have plummeted to well under \$1,000.

The only micros the new Kodak and DuKane devices are designed to operate with are IBM PCs and clones. In time, versions to operate with Apple's Macintosh micros should be available if history is any indicator—monochrome screen projectors for the Mac appeared

within months after the introduction of Kodak's Datashow. The projectors are available at computer and audio-visual shops.

—Mel Mandell

## New Way to Cut Power Bills

**P**OWER utilities may soon be offering big commercial users a new way to cut their electric bills. Domestic Automation Company (DAC) has introduced a commercial version of its widely used "intelligent register" for monitoring time of use, demand and load profiles for power users. Tens of thousands of the Foster City, Calif., company's registers for residential customers have been in use since 1987.

The detailed information the add-ons provide enable power companies to offer customers special off-hour rates—and then confirm that the customers are adhering to the off-hour usage. By stimulating lower usage during peak hours, the power companies can avoid the enormous expense of con-

## VDTs Exonerated: Myopia Blamed

**N**EARSIGHTEDNESS may be the culprit in the controversy over whether or not visual-display terminals cause vision woes.

A study done by researchers at the Colleges of Optometry at both Ohio State University and the University of Alabama at Birmingham revealed that workers with minor degrees of near- or farsightedness and astigmatism tended to report longer, earlier and more severe vision-related problems than workers with no refractive-error conditions. Of those with refractive errors, the nearsighted had the longest, earliest and most severe symptoms. The study was published in the September Journal of the American Optometric Association.

The researchers ques-

tioned 32 VDT operators about six symptoms they experienced during the previous month: headache, slowness in refocusing between far and near, double and blurry vision, eye irritation and eyestrain. The same operators were checked for common vision deficiencies. Of the 32, all but three were found to have small degrees of near- or farsightedness or astigmatism—even with the prescription lenses they were wearing when the study was conducted.

The study suggests some possibly bad news for employers: They may have to provide eye examinations for all VDT operators and not assign those with severe refractive deficiencies to prolonged terminal or micro operation. The good news? The study could generate a lot of business for optometrists.

—Mel Mandell

structing additional generating capacity or imposing area-wide brownouts when demand exceeds capacity.

The small registers are installed inside conventional watt-hour meters, of which there are tens of millions installed. Because the conventional meters are long-lived, inexpensive and would require considerable labor to replace, power utilities are loathe to replace them with the newer watt-hour meters that gather more than raw data on power consumption. DAC's solution is a microprocessor-based add-on that takes only five minutes to install and provides far more data than even the latest mechanical watt-hour meters. However, DAC's SuperMeters cost about \$100 each, much more than the watt-hour meters they are attached to.

In the past, some power

companies have attempted, with only partial success, to control overdemand by installing cutoff switches activated by radio signals on major home appliances, such as air conditioners. However, some resentful customers hindered the cutoffs by placing tin cans over the antennas of the switches.

The DAC add-ons don't eliminate meter readers, who must still visit each customer to draw data out of the registers into handheld terminals. But the registers raise the possibility of remote collection of the data by wire.

This would call for imposition of the data on the power line itself, to be collected at the nearest transformer to each customer. The batch data would then be transmitted to headquarters via phone lines.

—Mel Mandell

# LEADING 100

COMPANY (SYMBOL/EXCHANGE)	RANK THIS MONTH/ LAST MONTH	PRICE INCREASE LAST MONTH (%)	CLOSING PRICE (\$)	EARNINGS PER SHARE		LATEST DIVIDEND (\$)	P/E RATIO	DEBT/ EQUITY RATIO	LATEST 12 MONTHS' REVENUE (IN MILLIONS)
				LAST QUARTER (\$)	CHANGE FROM 1 YEAR AGO				
AEROSPACE									
Ronsan Cp (RONS/NASDAQ)	29	38.0	3.63	.17	NC	—	9.8	2.90	34.8
Fairchild Ind (FEN/NYSE)	3	25.7	12.88	.32	-45.8	.20	NE	2.39	407.4
Hexcel Corp (NXL/NYSE)	24	12.3	37.50	.65	30.0	.44	17.3	.71	380.8
Utd Technol (UTX/NYSE)	15	11.7	39.25	1.46	22.7	1.60	7.9	.43	17,727.7
Trans Technol (TT/NYSE)	21	10.0	19.25	.21	-32.3	.88	9.7	.81	213.8
Raytheon Co (RTN/NYSE)	13	9.3	69.38	1.84	22.7	2.00	10.2	.02	7,981.7
Rockwell Intl (ROK/NYSE)	14	8.9	21.38	.82	34.4	.72	7.5	.23	11,855.4
AAR Corp (AIR/NYSE)	19	7.8	26.13	.41	46.4	.36	19.5	.16	347.6
Sierracin Corp (SER/AMEX)	20	7.1	7.50	.15	-37.5	—	11.7	.37	75.3
Cdn Marconi (CMW/AMEX)	30	6.9	13.63	.18	-25.0	.28	NA	.00	214.3
CHEMICALS									
Flamemaster Cp (FAME/NASDAQ)	5	83.5	6.88	.11	57.1	—	25.5	.00	5.1
Georgia Bonded (GBFH/NASDAQ)	1	37.5	5.50	.41	NE	—	25.0	.08	33.4
Balchem Cp (BLCC/NASDAQ)	8	24.2	5.13	.10	42.9	.03	16.5	.21	7.4
Oil Ori Cp (DILC/NASDAQ)	50	21.1	23.00	.30	20.0	.20	21.3	.16	65.3
Ivdx Cp (IVX/AMEX)	4	16.8	13.88	.01	-75.0	—	NM	.06	13.5
Univar Cp (UVX/NYSE)	12	16.7	21.88	.46	43.8	.40	15.5	1.20	1,166.2
Crompt & Knowl (CNK/NYSE)	82	15.3	33.00	.85	41.7	.92	13.7	.17	259.0
Essex Chemical (ESX/NYSE)	28	14.8	35.75	.19	-13.6	.52	NE	1.83	246.0
Intl Minerals (IGL/NYSE)	47	14.2	45.25	.67	6600.0	4.00	14.5	.69	1,470.6
Colgan Carbon (CRBN/NASDAQ)	16	13.0	58.50	.83	62.7	.20	23.9	.25	193.7
COMMUNICATIONS									
Intl Mobile Mach (IMMC/NASDAQ)	52	50.0	11.25	-.36	NE	—	NE	.01	3.0
Vertex Comm (VTEX/NASDAQ)	59	44.4	3.25	.11	22.2	—	9.8	.22	18.9
Centex Telemgmt (CNTX/NASDAQ)	56	15.7	13.88	.11	NE	—	NM	.01	47.6
Utd Telcom (UT/NYSE)	15	15.3	39.50	.33	NE	1.92	32.4	2.32	3,280.0
MCI Communicatn (MCIC/NASDAQ)	18	13.0	19.50	.20	900.0	—	32.5	1.97	4,382.0
Acton Cp (ATN/AMEX)	47	12.8	14.25	-.71	-100.0	—	11.4	.00	75.1
Ericsson LM Tel (ERIC/NASDAQ)	16	12.7	45.50	-.33	-100.0	—	25.0	.38	4,721.2
Cellular Comm (COMM/NASDAQ)	49	12.5	20.25	-.01	NE	—	NE	2.70	45.9
Cinn Bell (CSN/NYSE)	32	11.3	34.50	.75	44.2	1.12	14.5	.71	689.1
AIM Telephone (AIMT/NASDAQ)	69	11.1	5.00	.05	-37.5	—	31.3	1.32	32.8
COMPUTERS									
MSI Data (MSI/AMEX)	140	95.9	17.63	.23	15.0	—	17.3	.04	91.6
Gould Inc (GLD/NYSE)	77	58.2	22.75	.72	1340.0	—	NE	.64	876.3
Fingermatrix (FINX/NASDAQ)	162	57.1	3.63	-.16	NE	—	NE	.00	.1
HHB Systems (HNBX/NASDAQ)	156	37.9	10.00	.18	12.5	—	16.7	.10	17.0
Gateway Comm (GWAY/NASDAQ)	178	37.5	2.75	.05	25.0	—	NE	.00	12.5
Verdix Cp (VRDX/DTC)	74	30.4	1.63	.02	NE	—	40.6	.02	7.0
Comp Microfilm (COMI/NASDAQ)	45	27.9	6.88	.13	30.0	—	16.0	.33	13.2
System Indus (SYSM/NASDAQ)	123	27.0	5.88	.00	-100.0	—	9.2	.20	138.3
Inmac (INMC/NASDAQ)	159	23.9	14.25	.25	13.6	.09	14.0	.00	222.8
Nati Micronetics (NMIC/NASDAQ)	58	23.0	3.69	.05	150.0	—	61.5	.90	38.8
DRUG MANUFACTURERS									
Zenith Labs (ZEN/NYSE)	71	99.1	2.25	-.18	NE	—	NE	.24	34.1
Proxis Biol (PRXS/NASDAQ)	58	34.2	5.88	-.21	-100.0	—	NE	.20	7.8
Ouramed Phar (ORMO/NASDAQ)	9	30.7	5.88	-.38	NE	—	NE	6.29	17.5
Viretek Inc (VIRA/NASDAQ)	15	28.1	18.25	-.39	NE	—	NE	.00	1.0
Adv Magnetics (ADMG/NASDAQ)	3	19.4	10.75	.03	-81.3	—	71.7	.00	4.0
Elan Cp (ELAN/NASDAQ)	70	19.2	8.50	-.07	NE	—	NE	.00	13.9
Hycor Biomed (HYBD/OTC)	4	19.1	2.31	.03	50.0	—	25.7	.15	7.5
Incstar Cp (ISR/AMEX)	72	18.8	10.25	.16	433.3	—	26.3	1.32	15.9
Newport Pharm (NWP/NASDAQ)	64	18.0	5.31	NC	NC	—	NE	.72	NC
Lypomed Inc (LMED/NASDAQ)	44	17.7	10.75	-.51	-100.0	—	NE	.70	161.1



The Leading 100 lists the 10 companies in each of 10 industries that had the highest stock gain over the previous month.  
(Figures as of 8/18/88.)

NA = Not available NE = Negative earnings NC = Not calculable NM = No meaningful figure

COMPANY (SYMBOL/EXCHANGE)	RANK THIS MONTH/ LAST MONTH	PRICE INCREASE LAST MONTH (%)	CLOSING PRICE (\$)	EARNINGS PER SHARE		LATEST DIVIDEND (\$)	P/E RATIO	DEBT/ EQUITY RATIO	LATEST 12 MONTHS' REVENUE (IN MILLIONS)
				LAST QUARTER (\$)	CHANGE FROM 1 YEAR AGO				
ELECTRONICS									
Electran Missiles (ECIN/NASDAQ)	6	138.1	1.50	.01	.0	—	NE	2.29	3.9
Bishop Inc (BISH/NASDAQ)	53	77.0	2.00	-.93	NE	—	NE	.00	10.1
Tech Ops Land (TD/AMEX)	146	58.4	47.13	.52	6.1	—	21.3	.04	18.8
Circon Inc (CCCN/NASDAQ)	239	47.9	4.63	-.14	NE	—	NE	.55	40.7
Telecomm Ntwk (TNII/NASDAQ)	30	47.5	3.88	-.15	-100.0	—	NE	.46	18.0
Taratel Inc (TTL/AMEX)	173	44.2	1.63	.04	300.0	—	12.5	1.00	9.7
Graham Field (GFI/AMEX)	120	33.3	3.00	.00	NE	—	100.0	1.85	29.5
Mitel Cp (MLT/NYSE)	121	33.3	3.00	-.02	NE	—	NA	.08	428.1
Orbit Instru (ORBT/NASDAQ)	95	33.2	6.50	.10	-41.2	—	29.5	.07	41.8
SHL Systemhouse (SHKIF/NASDAQ)	247	30.8	8.50	.18	-28.0	—	24.3	.02	202.7
HEALTH									
IPCO Corp (IHS/NYSE)	65	50.0	12.75	-.33	NE	.36	NE	.55	216.6
Hemodynamics (NMQY/NASDAQ)	23	44.0	9.00	.09	-10.0	—	7.9	.00	7.6
Survival Tech (SURV/NASDAQ)	20	42.7	6.25	-.14	-100.0	—	21.6	.70	28.4
Hlthdyne (NDYN/NASDAQ)	95	40.8	5.63	-.06	-100.0	—	NE	.05	89.1
Q Med (QKGG/NASDAQ)	75	36.0	2.38	-.28	-100.0	—	NE	.00	12.5
Monoclonal Antibod (MABS/NASDAQ)	80	31.3	5.75	-.20	NE	—	NE	.21	7.6
Biogen Inc (BGEN/NASDAQ)	10	30.2	8.63	-.04	NE	—	NE	.08	15.7
Lectec Cp (LECT/NASDAQ)	109	29.1	6.13	.10	66.7	—	21.1	.09	5.8
Circadian (CKDN/NASDAQ)	34	25.3	1.88	-.40	-100.0	—	NE	.00	18.8
Oncogene Science (DNCS/NASDAQ)	79	25.0	3.75	-.02	-100.0	—	NM	.00	5.3
METALS FABRICATION									
MLX (MLXX/NASDAQ)	25	18.2	3.25	.11	22.2	—	NE	8.31	385.5
Reuter Inc (REUT/NASDAQ)	22	17.2	17.00	-.04	NE	—	NE	.70	31.9
Caml Intertech (CTEK/NASDAQ)	36	16.9	19.00	.43	38.7	.56	14.0	.54	376.5
Pitt DesMoines (PDM/AMEX)	13	14.6	22.63	.88	576.9	—	12.6	.31	320.3
Insteel Inds (III/AMEX)	42	13.6	12.50	.26	-44.7	.24	5.9	.99	191.6
Deltak Corp (DLTK/NASDAQ)	16	12.0	7.00	.24	166.7	—	12.5	.48	31.6
Trinity Indus (TRN/NYSE)	27	11.1	31.25	.28	300.0	.50	32.9	.99	691.6
Adtec Inc (JAIL/NASDAQ)	37	9.5	4.38	.12	-29.4	—	14.1	.13	14.7
Am Lacker (ALGI/NASDAQ)	41	9.1	6.00	.16	-33.3	.28	5.5	.03	24.3
Graham Cp (GNM/AMEX)	6	9.0	7.63	.22	NE	—	54.5	.75	62.2
SCIENTIFIC & ELECTRONIC INSTRUMENTS									
Resdel Ind (RSDIC/NASDAQ)	91	93.1	3.38	-.01	NE	—	NE	1.39	22.9
Edison Contral (EDCO/NASDAQ)	79	42.9	2.50	-.02	-100.0	—	NM	.00	1.1
EIP Microwave (EIPM/NASDAQ)	69	41.2	6.00	-.26	-100.0	.12	NE	.22	11.6
Enviran Tectanics (ENVT/NASDAQ)	82	33.3	3.00	.00	-100.0	—	NE	.55	15.1
ENSR Cp (ENX/AMEX)	68	31.9	11.38	.11	-15.4	—	45.5	.01	97.6
Base Ten Syssts (BASEA/NASDAQ)	77	31.6	6.25	NA	NA	—	NA	NA	NA
Astrasystems (ASTR/NASDAQ)	36	30.0	6.50	.11	-15.4	—	17.6	.00	13.6
Orion Research (ORIR/NASDAQ)	53	28.6	9.00	.25	25.0	—	11.7	.08	32.8
Laser Cp (LSER/NASDAQ)	8	25.0	1.25	-2.05	-100.0	—	NE	.10	10.4
Clinical Data (CLDA/NASDAQ)	59	20.5	1.88	.03	-80.0	—	NE	.16	18.1
SOFTWARE AND DATA PROCESSING									
Cognas Inc (COGN/NASDAQ)	126	44.8	6.88	.05	-70.6	—	34.4	.10	85.7
Software Pub (SPCG/NASDAQ)	125	44.0	25.75	.48	336.4	—	18.5	.00	60.0
Hogan Syssts (HOGN/NASDAQ)	97	43.5	5.38	-.43	-100.0	—	NE	.00	40.1
Infia Science (INSI/NASDAQ)	132	33.3	1.00	.13	NE	—	NE	.35	12.3
IntelliCorp (INAI/NASDAQ)	76	33.1	3.50	.06	NE	—	NE	.00	20.4
Triad System (TRSC/NASDAQ)	101	28.9	14.50	.23	64.3	—	15.1	.01	125.7
Adv Camp Tech (ACTP/NASDAQ)	13	26.8	1.75	-.04	-100.0	—	NE	.30	8.1
Cybertek Cp (CKCP/NASDAQ)	82	26.3	2.69	-.06	NE	—	26.9	.03	22.4
Ashtan Tate (TATE/NASDAQ)	58	24.1	27.00	.44	10.0	—	14.9	.03	287.8
Adobe Syssts (ADBE/NASDAQ)	124	23.8	43.50	.41	86.4	.08	35.4	.00	55.8

SOURCE: MEDIA GENERAL FINANCIAL SERVICES

# Technology with Intuition

## THESE COMPUTERS WILL UNDERSTAND BODY LANGUAGE

■ By Robert Chapman Wood

**R**ESearchers AT Nippon Telegraph & Telephone (NTT) want to make working with a computer just like working with a person. For example, when you look closely at one part of a screen, the software will "see" your motion and provide more detail on the subject you're examining. When you look puzzled, the computer will recognize your confusion and provide help. A realistic representation of a face on the screen will alert you to errors in the most natural way possible by grimacing politely and speaking a gentle error message.

An NTT laboratory system called "head reader" is the first step toward this vision. It takes a digitized image of a computer user's face from a video camera and analyzes many of the user's movements, allowing the computer software to act on them. "My real dream is to create a robot that will completely understand human action," says Kenji Mase, a member of NTT's research group. "But for now I am concentrating on creating a computer interface that will understand the user's intention. We should not have to use a keyboard or a mouse to interact with the computer."

This work, conducted at NTT's Human Interface Laboratory in Yokosuka, is the kind of long-term research that until recently was rarely performed in Japan. In fact, only a handful of private laboratories in the world are involved in this type of work. Among them are AT&T's Bell Laboratories and Xerox Corp.'s Palo Alto Research Center.

The closest the Japanese came to this type of research were a few joint government-industry projects, such as Pattern Information Processing System (PIPS) project in the 1970s. PIPS

developed the know-how used in Japanese video cameras, scanners and thermal printers—including some devices in the head-reader project.

The head-reader system is not purely research, but it is not designed to produce specific products, either. It represents one of the first fruits of the fundamental research Japan's largest technology companies emphasized af-

Head reader's programs function by recognizing the outlines of a person's head, hairline and mouth. Today, head reader can recognize only "coarse" movement. It can tell whether a head is shaking "yes" or "no," moving left, right, toward or away from the screen, up or down. It can run on an Intel 80286 microprocessor-based microcomputer.

To allow the programs to communicate with the computer user NTT researchers have synthesized an image of a human head. Some 150 triangles represent the mouth. When features are modeled this way, they can easily be programmed to mimic the mouth motions of standard Japanese and English dialects and a convincing smile, frown and grimace.

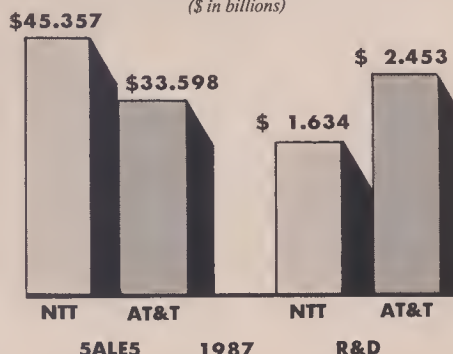
Although the head-reader system was conceived as part of a larger system called "body reader"—which will look at your entire body to judge fatigue, boredom, and other emotions or simply recognize whether you have left the room—NTT has so far done little work on reading parts of the body other than the head and mouth. NTT has not projected when the head reader or body reader will become part of a commercial computer interface.

For the most part, the technical strengths of the Japanese are still based not on superior research but on superior tracking of the world's technical literature, careful value analysis, better design and excellent manufacturing. That could be changing, however. "We think that basic research is the most important field in which we should improve," says Mase. U.S. companies that look to Japan for product and process innovations should also start to look there for radical new ideas. ■

*Robert Chapman Wood is a writer and business consultant specializing in the technology and economies of the Orient.*

### AT&T Outspends NTT On R&D

(\$ in billions)



ter 1980. Japan still does less research (as opposed to product design and development) than the United States. For example, NTT's sales are about 35 percent greater than those of post-divestiture AT&T, but its research and development spending is about one-third lower. NTT's Human Interface Laboratory has a 250-person research staff.

The Japanese are publishing much of their new fundamental research in English. Mase and two other NTT scientists reported on the head reader at a conference of the Institute of Electrical and Electronics Engineers last year. In their paper, they noted that human beings "easily estimate people's intentions from their gestures" and that, eventually, "computers possessing 'eyes' will be able to smoothly interact with people. Computers having a 'face' and 'body' will also be a great help."





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■ By Robert Ch

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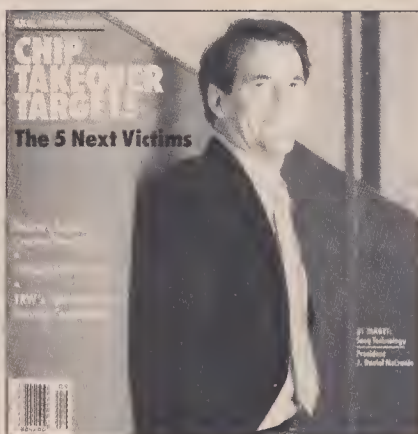
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# The Quest for Clarity

## SEEKING TOOLS TO IMPROVE COMMUNICATION

■ By Mark J. Estren

*The Business Writing Problem Solver.* By Herman R. Holtz.  
Dow Jones-Irwin. 248 pages. \$37.50.

*The McGraw-Hill Handbook of Business Letters.* By Roy W. Poe.  
McGraw-Hill. 320 pages. \$44.95.

*The Manager's Complete Guide to Speech Writing.* By Burton Kaplan.  
The Free Press. 192 pages. \$22.50.

IN THE NOT-TOO-DISTANT past, it was all too common for a letter or report to go out in less-than-optimum form, because the cost in time and labor to redo it seemed too high. Now, thanks to the ease of revision made possible by computerized word processing, there is no excuse for anything less than the best. So why are so many business communications still so abysmally bad? Because human communication ability has not kept up with technological communication ability. Many businesspeople have never learned to express themselves well in anything other than small groups or one-on-one meetings (and sometimes not even then). This can be a particular problem for executives who deal with high technology because the complexity of the information being handled makes it that much more important to have a clear, organized, systematic approach to saying what needs to be said.

All these books, each in its own way, are about organizing for clarity. *The Business Writing Problem Solver* and *The McGraw-Hill Handbook of Business Letters* are conceived as reference works, both from their size (each measures 8 3/4 by 11 1/4 inches) and from their layouts; *The Manager's Guide to Speech Writing*, whose writing style is

breezier and less formal than that of the other works, is intended more as a pleasant read and a get-with-it guide to verbal presentation.

*The Business Writing Problem Solver* is the most comprehensive book of the three. Author Herman Holtz, president of a consulting firm, tackles everything from letters and reports to brochures and press releases with a mix

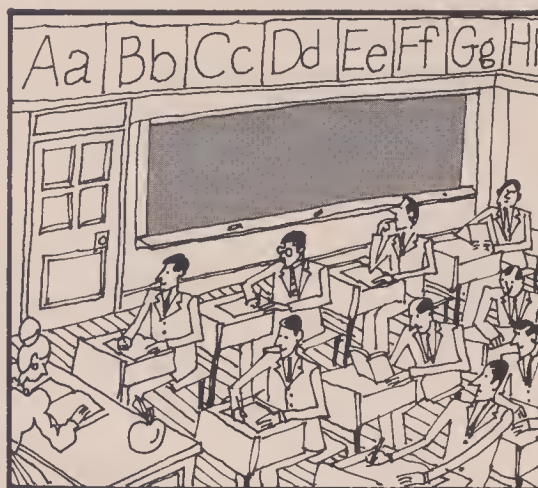
little but specific examples, plus analyses of the strengths and weaknesses of those examples. That is a weakness, since what narrative Poe does present is engaging and useful: "There are the folks who have an uncontrollable urge to add *uate* to certain words to indicate action. There are hundreds of good *uate* words—perpetuate, evaluate, fluctuate, and evacuate, for example—

but among these are not *actuate*, *effectuate*, *eventuate*, and others of that ilk."

Poe is particularly harsh on writing that is lifeless and stale. So is Burton Kaplan, a speech writer and public-relations executive. Kaplan's *Manager's Complete Guide to Speech Writing* is an excellent lesson in style, organization and verbal presentation.

Kaplan offers readers "Strategic Theory" and "Strategic Practice," plus nine sample speeches that implement his approaches—which are carefully calculated to give the impression of artlessness. "It is naive to think there is anything natural about good communications," writes Kaplan. "The only thing artless about a good speech is the way it sounds."

Working Kaplan's way takes practice, since it involves careful preparation as well as writing, rewriting, compression, editing and rearranging. The recommendations of Holtz and Poe may also take some getting used to. But all these writers' ideas are well worth your time, because whatever the difficulties of communicating clearly, the risks of failing to do so are even greater, and are all around us in the form of troubled companies and missed opportunities. High-technology business—indeed, all business—is enough of a battleground without managers putting themselves at a competitive disadvantage by failing to use one of their best weapons: clarity and simplicity in communications. ■



of savvy comments and model documents. Holtz's points, even when arguable, are clearly made: "Subtlety has no legitimate place in advertising, because people simply do not pause over, savor, or contemplate advertising texts."

Unfortunately, the value of Holtz's book as a reference work is compromised by the sometimes difficult-to-follow page layout (especially when documents flow from one page to the next) and by the fact that the book is printed on paper that looks and feels altogether too much like newspaper.

In contrast, Roy Poe's *McGraw-Hill Handbook of Business Letters* is a handsomely designed volume whose every page—even the inside covers—is brimming with information and references to specific examples. Indeed, Poe, a business education consultant and former McGraw-Hill executive, offers



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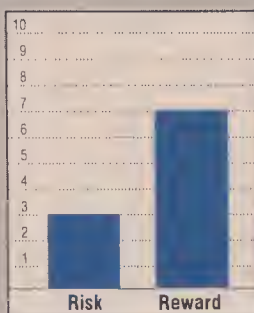
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2 Estimated 1988 Revenue	\$2.5 B
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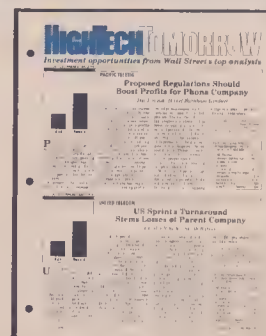
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# Patent Applications

**NEED AND TIMING CAN BE AS CRITICAL AS VALIDITY**

## ■ Norman E. Carte

**S**EVERAL FACTORS must be considered before deciding when to file for a patent. These factors include the need for patent protection, the probability of an enforceable patent actually being issued, the economic rewards of patenting and the disclosure of the invention to competitors.

The primary reason for applying for patent protection is to allow you to exclude others from making, selling and using your invention in the United States, its possessions and territories, for a period of 17 years. A less common reason for applying for a patent is to prevent others from excluding you from making, selling or using the invention. Such a patent is called a defensive patent. A defensive patent might be used where the technology involved could be beneficial to your company, but wouldn't yield a significant competitive advantage.

Once need has been established, you must analyze completely the costs, risks and benefits associated with the application. How much of a technical lead will a patent give you? If your competitors have a method for producing an equivalent product that doesn't cost significantly more and is also readily marketable, then little would be accomplished by spending money to protect technology that your competition doesn't need. You have to determine the true technical advantage that the exclusive right to the invention will provide.

The goal in obtaining patent protection is to gain a competitive advantage. This is usually accomplished by acquiring the exclusive right to a technology that either lowers the cost of making an existing product or creates a superior product at a price not significantly higher than the price of competitive prod-

ucts. The case in which a patent permits the owner the exclusive right to manufacture and sell a product that otherwise doesn't exist is rare.

There is a benefit to having a patent application on file, even when the probability of a patent being issued is very low. Once a patent has been applied for and an application serial number and filing date have been received by the ap-



plicant, then the applicant can mark the product "Patent Applied For" or "Patent Pending." This has the effect of discouraging competitors from making and selling the product. While there is no legal right to exclude others from manufacturing and selling these products, quite often a competitor will be unwilling to assume the financial risk of the tooling or setup required for a new product line. Of course, this strategy is most effective where the cost of initiating the new product line is high.

The probability of obtaining an enforceable patent is not easy to calculate. Prior art must be carefully studied and the difference between it and your invention considered. This is best done by a patent attorney experienced in the field of your invention.

The cost of the patent comprises the cost of the application and the mainte-

nance fees. An application can cost anywhere from about \$2,000 to tens of thousands of dollars. This will depend upon the complexity of the invention and your attorney's ability to efficiently understand and describe it. An estimate of the cost to make the application can be provided by your attorney. Maintenance fees are only applicable if the patent issues and is to be kept in force.

They will amount to several thousand dollars over the life of the patent.

The probability of an enforceable patent being issued should be considered in conjunction with the economics involved. For example, if it appears that it will cost \$15,000 to apply for and prosecute an application, then the \$15,000 is clearly at risk, since a valid patent may never be issued. The benefits derived from obtaining a valid patent should be much greater than the money spent on obtaining it. Therefore, it would make sense to spend the \$15,000 if hundreds of thousands or millions of dollars in profit could be realized. However, if the same patent would increase profits by only \$50,000 over the life of the patent, then filing most likely would not be justified. The probability of obtaining a patent with adequate protection must be great enough to make the risk worthwhile.

Forcing your competitors to rely on alternative technology may seem strategically sound, but if it causes them to pursue avenues that are likely to give them a competitive advantage, this strategy could backfire. Disclosure of the invention to your competitors is a very important consideration in deciding when to apply for a patent. A valid patent must contain all the information needed by competitors to manufacture your invention. When a patent is issued, it becomes public.

The disclosure of the details of your

DAN CULLHANE



invention may not be a problem. Those details may already be known, or may be evident from a casual examination of the product. Conversely, the newly issued patent may be the only source of the particular details involved in making the invention. In this case it might be best not to file; the invention could be protected under trade secret law.

*A valid patent may not be obtained if the invention was in public use.*

Delays in obtaining a patent can be as critical as timing your application. Sometimes the filing and issuance of a patent may be delayed long enough for the competition to have learned the details of the invention through parallel development or reverse engineering. There is the risk of never being able to obtain a patent if care is not taken during this delay. A valid patent may not be obtained if the invention was in public use or on sale in this country more than one year prior to the filing of your application. Your own use and sale of the invention more than a year before your application is filed will bar your right to a patent just as effectively as though this use and sale had been done by someone else. A published description of the invention anywhere in the world more than one year before filing the U.S. application will also bar its issuance. Any public use, sale or publication before the application is filed in some foreign countries will bar the issuance of a valid patent in those countries.

*Norman E. Carte is a registered patent agent. He is on the board of advisors to the National Inventors Foundation.*



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# Birth-Control: Fertile High-Tech Business

*Innovators from individuals to giant pharmaceutical houses  
are applying technology to contraception*

BY FRANCESCA LUNZER

**S**EVERAL YEARS AGO, researchers at Harvard Medical School tried to verify an old myth about birth control: that Coca Cola, topically applied, was an effective contraceptive. The researchers poured Coke Classic and New Coke into separate, sperm-filled petrie dishes and found that Coke Classic killed off more sperm.

The experiment was a gag, but petrie dishes, batteries, genetic engineering and biodegradable polymers are all part of an emerging arsenal of new contraceptive technologies. Over the next 10 years, devices such as time-release drugs and battery-powered diaphragms, as well as genetically engineered human proteins and surgical techniques for temporary sterilization will supplement and replace the currently available contraceptives.

Fear of liability suits, combined with the Food and Drug Administration's stringent testing requirements, has made the birth-control business ex-

tremely risky. A few years ago, eight of the country's big pharmaceutical companies made contraceptive products. Now that number has dwindled to three—Wyeth, Syntex and Johnson & Johnson's Ortho Pharmaceutical division. "That's not only bad for product availability, it reduces the amount of research being conducted in the field," said Gerald Zatuchni, professor of obstetrics at Northwestern University Medical School and editor of *The Journal of Contraception*.

With pharmaceutical companies fleeing the contraceptive market, research funding must come from other sources. The U.S. government has picked up some of the slack, as have private agencies that are anxious to promote population control in the Third World. World-wide funding for contraceptive research and development is woefully inadequate, according to Jacqueline Forrest, Ph.D., vice president for research for the Alan Guttmacher Institute, a New York-based family-plan-

ning research center. In 1985, the most recent year for which data are available, eight major nonprofit organizations in the United States, France, India and elsewhere spent only \$30 million on such research. Spending by the private sector was only slightly higher, according to Forrest. Marketing a new product costs between \$50 million and \$100 million, so companies developing birth-control products have had to find a new way to develop those products.

That new way seems to be using agency funds for development and testing, then finding a marketing partner to sell the product after FDA approval. "Small groups of people are trying to get things developed and, unexpectedly, they are doing it," said Wayne Bardin, director of the Population Council, a nonprofit research institute in New York. Bardin thinks new products will arrive, but that it will take longer to get them to market than it would take large pharmaceutical houses.

The agencies doing the most funding





are the National Institute of Child Health and Human Development, which grants between \$6 million and \$10 million annually; the U.S. Agency for International Development, whose Contraceptive Research and Development program (CONRAD) spends another \$4 million to \$5 million each year; the World Health Organization, which has about another \$5 million; and the Population Council, which spends around \$4 million on research. The rest comes from private industry—mainly the Ortho Pharmaceutical division of Johnson & Johnson.

The endeavor is worthwhile. Despite today's wide choice of contraceptive methods—condoms, the Pill, intrauterine devices, spermicides and diaphragms—50 percent of all pregnancies in the United States are unintended, according to the Guttmacher Institute. About 30 percent of all pregnancies in the United States end in abortion, said Forrest.

From a strictly technical standpoint,

existing contraceptives work very well. Only a small percentage of unintended pregnancies can be blamed on the failure of a birth-control device, according to Dr. Louise B. Tyrer, vice president of medical affairs for the Planned Parenthood Federation of America. Far more often, the problem lies in improper use of those devices. Women forget to take their daily Pill; lovemaking couples neglect to stop the action to either use a condom or insert a diaphragm. "People have excellent birth-control methods available to them," said Dr. Tyrer. "What they need are hassle-free ones."

The most effortless contraceptive approach is the intrauterine device (IUD), which can be placed in the uterus during a visit to a doctor's office and remains effective for several years. But infections caused by the devices led to huge lawsuits in the 1970s, compelling two IUD manufacturers—G.D. Searle and A.H. Robbins—to take their products off the market.

Two IUDs are still being sold. One,

from Alza, works by releasing progestin, the most widely prescribed contraceptive hormone. The other is the ParaGard T380A, recently introduced by GynoPharma of Somerville, N.J. The ParaGard, like earlier IUDs, contains copper, which prevents conception by inhibiting transport of the egg to the fallopian tube. But GynoPharma is taking no chances: Women who use the device must sign a lengthy informed-consent form.

The U.S. Agency for International Development (AID) is attempting to provide development funds and attract private-sector interest. If a product looks promising, another AID agency, Family Health International, funds human tests. "We try to perform marriages and see if we can bring a product along, and then the private sector can take it over," said Henry Gabelnick, director of extramural research and product development for the CONRAD program. If a product makes it to market, companies agree to provide it to Third



World countries at cost, making their profits in other parts of the world.

Although product development might be further along if more major pharmaceutical companies were still in the business, new contraceptive products are nevertheless on the way. Some could be on the market in the next couple of years.

The most exciting innovations involve injectable or implantable drugs that would remain in the body and deliver contraceptive hormones over long periods. "The implantables and the injectables have the greatest future for us," said Tyrer of Planned Parenthood. Already popular in foreign countries, these drug-delivery systems get high points for ease of use. Companies are developing several different systems that can deliver contraceptive hormones—usually forms of progestin—over periods ranging from a month to several years.

"Of all new contraceptive products in development," said Northwestern's Zatzuchi, "the biodegradable polymers have the most promise." One factor in the technology's favor is the anticipation of quick regulatory approval. Many of the degradable polymers being tested for delivering contraceptives are already in routine use—surgeons use miles of the material as "dissolving" sutures, which will probably speed up FDA approval.

The first such product to be approved in the United States will be implantable, but not biodegradable. The Norplant capsule, a matchstick-sized polymer capsule, will go just under the skin of a woman's arm and deliver contraceptive steroids for five years; after that, the empty capsule can be replaced by a new one. The capsule, which has been approved in 12 countries, has been licensed to Lierais of Finland and is now awaiting FDA approval in the United States. The Norplant capsule can be taken out at any time, but won't degrade on its own.

Research Triangle Institute in North Carolina has developed Capronor, a biodegradable implant that delivers contraceptive steroids for about 18 months before breaking down harmlessly. The device may also be removed earlier. Capronor is being tested with funds from the National Institute of Child Health and Human Development (NICHD) and also from the World Health Organization. The Capronor capsule will be marketed by a pharmaceutical firm



Worldwide funding for contraceptive research and development is inadequate, according to Jacqueline Forrest, Ph.D., at the Alan Guttmacher Institute.

that has not yet been disclosed.

Tiny, injectable capsules are being developed at several small companies and research organizations. Biotek of Woburn, Mass., received NICHD funding for a polymer sphere that releases progestin into a woman's bloodstream. In animal tests, the sphere delivers the drug for a year. The company has not yet received funding for testing on humans.

Boston-based Endocon has developed another form of injectable capsule. Endocon's rice-grain-sized, natural-material pellets are permeated with a contraceptive hormone. Four pellets are implanted in a woman's arm; as each erodes, it delivers a preset amount of the hormone each day for at least a year. The daily dose from these capsules is lower than that of the oral contraceptives being used today and, supposedly, have fewer side effects.

■

*Right now, the  
only drugs used  
to prevent pregnancy  
are the hormones  
estrogen and progesterone.*

■

Endocon funded the product's development on its own. Early stages of testing on humans, sponsored by AID, suggest that Endocon is safe and effective. No decision has been made on who will market the drug.

Development of another injectable sphere began at the Southern Research Institute in Birmingham, Ala., and has since been taken over by Stolle Research of Cincinnati. This tiny device, made of a biodegradable polymer, would last at least three months. Human testing is being funded by Family Health International; Ortho Pharmaceuticals will market the drug and plans to apply for FDA approval in about a year.

Sterilization is the most popular form of contraception in the United States, used by 22 percent of women and 11 percent of men. Two new surgical procedures could make the practice even more prevalent.

One technique is a temporary vasectomy. As currently performed, a vasectomy involves cutting the vas, or sperm-carrying tube, and is irreversible. But Lourens J.D. Zaneveld, head of obstetrics and gynecological research at Rush-Presbyterian-St. Luke's Medical Center in Chicago, has developed a silicone blocking device to be surgically placed in the vas. Removing the silicone plug lets sperm flow again, effectively reversing the procedure. The device is being developed by Bivona Surgical of Gary, Ind., and is undergoing early tests in Brazil.

The other new procedure is for women. Researchers at NBR Inc. of Raleigh, N.C., have developed a biodegradable material doused with an iodine-based drug. Surgically applying the drug-soaked material to a woman's fallopian tubes causes an inflammation. After the material biodegrades, healthy scar tissue forms, closing off the fallopian tubes. Family Health International is funding tests, and NBR will probably market the drug.

Around the world, one in five women of childbearing age prevents pregnancy with oral contraception. But problems with the Pill—it can cause mood swings, weight gain and breast tenderness—were creating great interest in new drugs.

Right now, the only drugs used to prevent pregnancy are the hormones estrogen and progestin. Estrogen prevents ovulation; progestin works by interfering with progesterone, the hor-



more that facilitates the egg's travel from the ovaries into the uterus. Sometimes the two hormones are given in combination, but more often progestin is given alone. The doses of both have been sharply reduced since the Pill was first introduced in the 1960s.

At least two research projects are underway that would give women new contraceptive drugs. Biogen of Cambridge, Mass., is working on genetically engineering a protein called mullerian inhibiting substance, or MIS. This protein, which is found in fetal tissue, prevents an egg from maturing to the point at which it can be fertilized. The protein normally occurs in women just before and just after birth. Human testing has not been done, and the drug remains at least five years away from market.

Ortho Pharmaceutical is testing another protein, Inhibin, that inhibits the growth of ovarian cells. The product,

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*"People have  
excellent birth control  
methods available to  
them. What they  
need are hassle-  
free ones."*

■

called a growth factor, is in equally early stages of research.

A third major drug project may produce both a male and a female contraceptive. A family of hormones called gonadotropins, or GNRH, causes ovulation in women and production of sperm in men. Researchers have developed drugs that inhibit gonadotropins, called GNRH agonists. Unfortunately, these drugs also shut off estrogen production in women, causing early menopause, and they stop testosterone production in men, causing impotency. However, research is continuing at universities and at Syntex and Ortho Pharmaceuticals to find ways to make GNRH agonists benignly effective. The drugs are doubly attractive because they also show promise for treating prostate cancer, which kills 28,000 men each year.

Both MIS and GNRH agonists are natural proteins, and thus do not work when taken by mouth; the digestive system renders them ineffective. Injection is the usual delivery method, but women will probably not be willing to take daily shots to prevent pregnancy, so new delivery systems are being developed along with the proteins. Drug Delivery Systems of New York is working on a battery-powered patch that would deliver the proteins through the skin, and Gynex of Deerfield, Ill., has developed a chemical carrier called Redox that can pass through the membrane that shields the brain from most substances. Tablets or wafers made with Redox could be placed under the tongue, delivering the drug directly into the bloodstream.

Electronic technologies also are entering the birth-control arena. Now that a second intrauterine device has been approved, attention has turned to new methods of assuring that the IUD is in place. The traditional approach is to attach a fiber thread, which can be felt by reaching into the vagina. But these threads provide a path for bacteria to enter the uterus and cause infection. Ortho Pharmaceutical is sponsoring work at Georgia Tech on a magnetic IUD. The device, made from a magnetic metal alloy, can be detected by an electronic sensor held outside the body.

Another device, which uses low voltage to kill sperm on contact, has been developed by Steven Kaali, medical director of the Women's Medical Pavilion, a family-planning institute in Dobbs Ferry, N.Y. This device, which has a tiny battery to produce less than 100 microamperes at 2.8 volts, can go in the cervix by itself or be placed in a diaphragm or cervical cap.

Neither technique has seen human tests, but prototypes implanted in baboons did prevent pregnancy, according to Kaali. Development funding has come from private sources, and Kaali is hoping to attract the interest of a pharmaceutical company for testing and marketing.

None of these ideas will be worth a dime unless \$50 million to \$100 million is available to register the products with the FDA and manufacture and market them. "If anything looks promising, only a large company has the infrastructure to do clinical trials and marketing," said John McGuire, vice president of preclinical research and development at Ortho. ■



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# Smart Maps: New Route To Profits

*Digital-map systems can save business  
up to \$50 billion annually*

BY EDWARD WARNER

# W

HEN A GOVERNMENT program offered Canadian oil companies financial incentives to drill more wells, Canadian Occidental Petroleum wanted to drill as many as possible before the program ended. Because drilling just one oil well costs at least \$500,000, the Calgary, Alberta-based company didn't want to proceed helter-skelter, so it created a computerized map that simulates the "lay of the land" thousands of feet below ground.

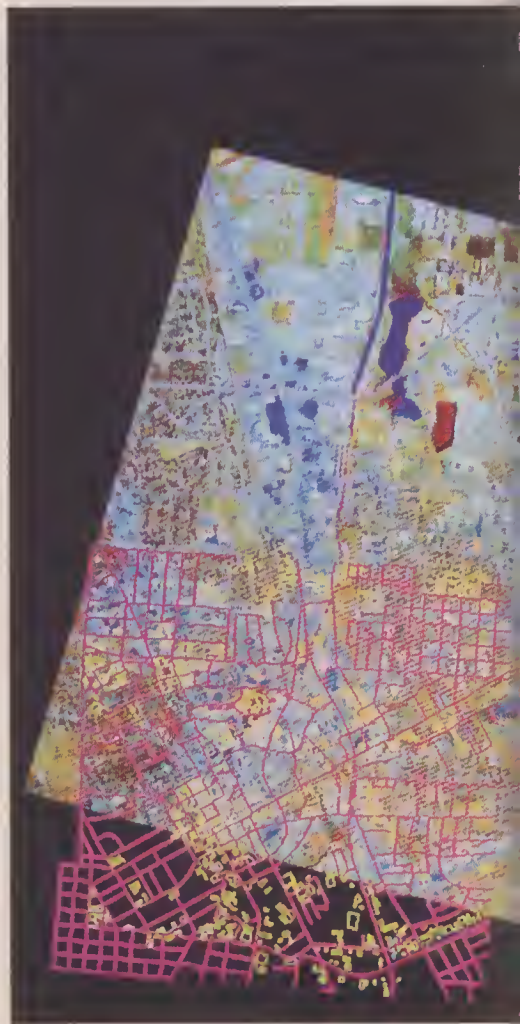
The map, based on how sound waves reflect off layers of underground rock, shows the pockets between those layers where oil might be found, explained

Frank Mayhood, manager of computer graphics at Canadian Occidental. Without the map, he added, the company would have been able to drill only about six wells. With it, he said, the company was able to drill 12 wells—receiving an additional \$2.5 million in government incentives. Canadian Occidental is a pioneering commercial user of digital, or electronic, mapping. City governments and federal government agencies were quick to recognize the advantages of digital maps, and mapmakers use them to automate production of paper maps. Because digital maps can be changed easily—sometimes with just a click of a computer mouse—they are popular for designing roads and power-line net-

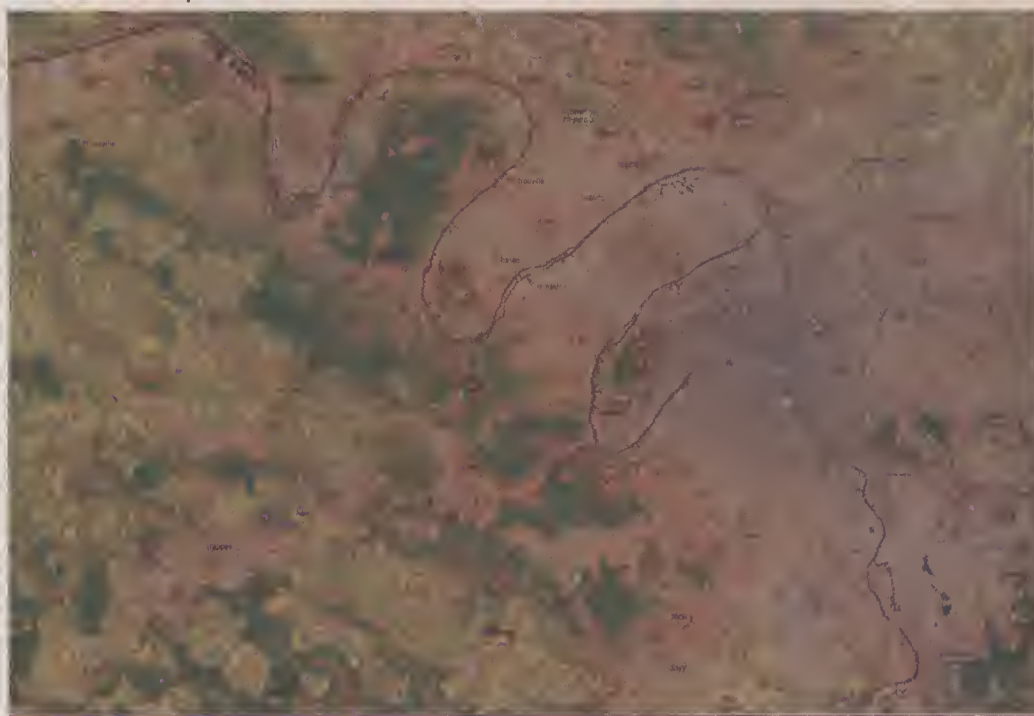
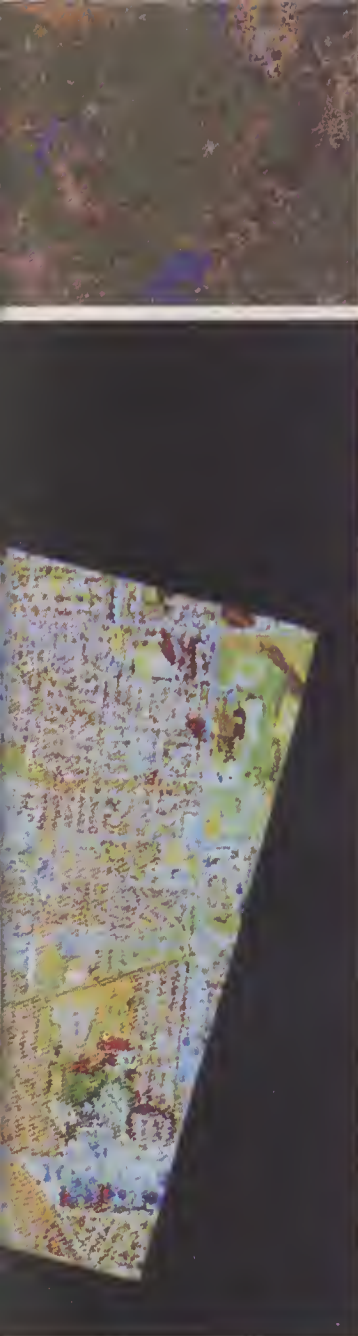
works and for updating information.

What is new in digital mapping is the coupling of electronic maps with external databases, such as U.S. Census Bureau information or a city's property-tax rolls. The resulting geographic information system (GIS) enables users to zero in on specific features. For example, a topography indicating house and building locations can be displayed on a screen, and each structure's assessed tax value or how much electricity it consumes can be accessed from the GIS's database.

Business users are a prime market for GIS systems, said Jack Dangermond, owner of Environmental Research Systems Institute (ERSI), a ma-







ETAK INC., INTERGRAPH CORP., SOTEX AMERICA CORP., ENVIRONMENTAL SYSTEMS RESEARCH CORP.

major GIS software vendor in Redlands, Calif., whose clients include Shell Oil and Dun & Bradstreet. A GIS of a city, with census data for each address, for example, would show a retail chain the optimum site for a new store—a neighborhood where incomes and ages are typical of its customers. Pennsylvania Power & Light, an Allentown-based regional power utility, uses census data and its GIS to find homes that might be ready to convert from coal or oil heat to electric heat. The utility also uses its GIS to route its meter readers and help find the right locations for new power plants, said land-use-systems planner Douglas Heivly.

Dataquest, the San Jose-based mar-

ket researcher, projects that the digital-mapping market will grow from \$390 million in 1987 to \$779 million in 1992. Of that 1992 total, it added, \$616 million should be GIS sales, which are expected to reach \$190 million by the end of this year. Going a step further, Pete Shaw, director of environmental-applications marketing for Prime Computer, believes GIS products are now in such demand that "there is no difference between the digital-mapping and the GIS market."

One reason for the digital-mapping industry's growth is the long-term commitment to digital mapping of its largest customer—the federal government. The government's primary map-mak-

ing agencies, the Defense Mapping Agency, the U.S. Geological Survey (USGS) and the Census Bureau, will use GISs. The USGS conversion alone involves 55,000 topographical maps that comprise nearly the entire United States land mass. Because the agency will sell the digital "topo" maps, which show settlements, waterways and roads, they represent a convenient means for businesses to sample digital maps. The maps will cost \$90 for the first map, and \$7 for each additional map, in groups of five or more, a pricing scheme that USGS geographer David Wolf believes "is going to open up the whole field."

The U.S. Census Bureau plans next



year to release the first nationwide digital street-map system. These maps will at last make digital mapping widely useful for vehicle routing, said Keith Druhl, an account representative with Geographic Data Technology Inc. (GDT), which will sell the Census Bureau's digital maps and complementing software. Claiming that \$500 billion is spent each year in the U.S. to transport people and things, GDT President Donald Cooke said that digital mapping can yield a five percent to 15 percent increase in routing efficiency. He estimated that that efficiency could save business as much as \$75 billion a year.

Routing via digital-map systems promises to become a hot item. For example, Pizza Hut customers in Kansas City and 19 other cities call a central telephone number, where an employee

takes their order and uses a digital map to route the order to the closest Pizza Hut shop. United Parcel Service (UPS)—as a result of its 1986 purchase of Roadnet Technologies, a Hunt Valley, Md., producer of routing software—expects to launch digital-map-based routing nationwide for its delivery fleet. The system is “real Star Wars,” observed UPS spokesman Ken Sternad. “If a traffic light goes out somewhere, in a matter of seconds, [the software] can reroute all the vehicles in the area.”

Also encouraging the digital-mapping industry's growth is the decreasing cost of the minicomputers that run GIS packages. Pennsylvania Power & Light, which had a mainframe-based digital map as early as 1978, recently converted to a more sophisticated GIS

that runs on a Digital Equipment Corp. VAXstation 3500, a desktop minicomputer. Personal computers are also powerful enough to run digital-mapping systems. Mapinfo Corp. offers a \$750 program for the PC, with which users can create digital maps from their data.

The granddaddy of GIS packages, the 15-year-old Ultimap, has, in two years, declined in price from \$300,000 to \$50,000. That includes the software and an Apollo minicomputer, reported Jerry Robinson, president of Ultimap Corp., the company that licenses Ultimap from its developer, the city of Minneapolis. Developed at a cost of \$2 million to \$3 million, Ultimap has allowed Minneapolis to reduce its staff of street designers from 90 to 30 since 1974, observed Bradford Henry, head of the





city's street-design section. Bradford estimated that the city has saved \$25 million with Ultimaps, not including the revenues from its licensing arrangement with Ultimaps Corp.

Ultimaps's database-management system—its newest feature—enabled Minneapolis to compare the response times of fire trucks with the locations of fire stations. Several fire stations were relocated as a result. It also pinpointed the ideal locations for a new garbage-burning facility and a convention center.

Such uses have spawned the boom in the use of digital-mapping systems by city governments. Digital-mapping systems have been created by the cities of Louisville, Memphis, Nashville, Albuquerque and Indianapolis, where a \$9.2 million GIS will come on-line next year. The Indianapolis GIS, called IMAGIS, covers a 492-square-mile area, provides information accurate to within two feet and, if printed, would produce 54 layers of maps, said a spokeswoman. Nationally, the U.S. Forest Service plans to create a GIS to better manage each national forest.

The increasing interest in GIS products has been great news for companies like Intergraph, which began life as a CAD supplier and now earns one-third of its revenues selling the hardware and software that comprise GISs. Intergraph has the lion's share of the systems market, variously estimated by analysts at around 35 percent. Its competition includes IBM, DEC and Prime, which recently sold a \$64 million digital-mapping system to the U.S. Fish and Wildlife Administration. Also profiting from digital mapping's popularity are GIS software suppliers, such as Environmental Systems Research Institute and Geographic Data Technology Inc., and companies, such as Analytical Surveys Inc., that create customized maps.

Even the makers of paper maps stand to profit from digital mapping, because such systems automate map-drawing. Although automation is expensive, "Once you create that [digital] database you can create new maps using the same basic information," said Rand McNally spokesman Con Erickson. Rand McNally just published its first paper map created with a digital-mapping system: a Detroit-area street-finder. Ultimately, said Erickson, the Rand McNally Road Atlas, which includes 17,000 small changes this year, will be produced with a digital-mapping

## VENDOR LIST

Need More Information? Following is a list of the vendors mentioned in this story and their telephone numbers:

**Analytical Surveys Inc.**  
1935 Jomboree Drive  
Colorado Springs, CO  
80920  
(719) 593-0093

**Apalla Computer Inc.**  
330 Billerica Road  
Chelmsford, MA  
01824  
(508) 256-6600

**Digital Equipment Corp.**  
146 Main St.  
Maynard, MA 01754  
(508) 493-5111

**Environmental Systems Research Institute**  
380 New York St.  
Redlands, CA 92373  
(714) 793-2853

**Etak**  
1455 Adams Drive  
Menlo Park, CA  
94025  
(415) 328-3825

**Geographic Data Technology Inc.**  
13 Dartmouth College  
Highway  
Lyme, NH 03768  
(603) 795-2183

**Intergraph Corp.**  
One Madison Industrial Park  
Huntsville, AL 35807  
(205) 772-2000

**Mopinfo Corp.**  
Hendrick Hudson Bldg.  
200 Broadway  
Troy, NY 12180  
(518) 274-8673

**Prime Computer**  
Prime Park Way  
Natick, MA 01760  
(508) 655-8000

**Rand McNally Corp.**  
8255 North Central  
Park  
Skokie, IL 60076  
(312) 673-9100

**Scitex America Corp.**  
Eight Oak Park Drive  
Bedford, MA 01730  
(617) 275-5150

**Ultimaps Corp.**  
2901 Metro Drive  
Suite 314  
Minneapolis, MN  
55425  
(612) 854-2382

system.

Companies that make systems strictly for automated map-drawing, such as Scitex America Corp., are also delighted with the digital-mapping boom. Scitex supplies systems to such giants of map production as the National Geographic Society.

Ironically, digital maps are usually created by hand. Working with an aerial photograph or a paper map, a technician highlights points on the landscape, such as roads, waterways and elevations. A photograph or paper map cannot simply be entered into a computer with an optical scanner, because the image would remain static—a picture that cannot be manipulated. Besides, "most people don't want all the information contained in a photo," said George Southard, vice president of Analytical Surveys Inc., the maker of Louisville's digital map.

That's not to say that customers don't want small details; Analytical Surveys' digital map of Louisville and

its surrounding county shows all parking meters and signposts. Nor is it to say that photos aren't important to digital mapping. To give a digital map an underlying color or topography, equipment from Intergraph Corp. allows a digital map to be laid atop a photo of the landscape.

Other images often added to a digital map are infrared satellite images that show soil types and old paper maps that show businesses and waste-storage facilities that have long since been abandoned—information that can help business and real-estate developers choose building sites on solid ground free of hazardous wastes. Digital maps consist of several "overlays"—separate sub-maps for roads, electrical lines or waterways, for example. Also, the user can choose to view the digital map with only one overlay or in a close-up view.

Digital mapping holds great promise for commercial and government applications, but the consumer market is so far largely untapped. In the early 1980s, Etak Inc. marketed, through California stereo stores, a dashboard-mounted computer called the Navigator, which displayed a digital map showing the driver's location. "As you drove," said Andrew Pitcairn, senior Etak account manager, "the map moved past your location; what was ahead of you out the window appeared ahead of you on the map." The company sold about 2,000 Navigators—fairly impressive given the the product's \$1,500 pricetag.

Etak has since exclusively licensed the Navigator in the United States to General Motors, which has yet to incorporate it into a production auto. One reason may be that the Navigator's maps are fed into its computer from digital tape, a limited means of data storage. A map of the San Francisco Bay area alone fills three tapes. However, Etak has just begun shipping to Blaupunkt, its European licensee, a version of the Navigator that uses CD-ROM discs, which can each store up to 500 megabytes of information. The spread of CD-ROM, Pitcairn believes, will hasten the consumer market for digital maps.

Until then, though, it's a paper-map world as far as consumers are concerned. And, said Rand McNally's Erickson, "the price and convenience of paper are going to retain the advantages of paper maps for some years down the road."

## How to tap 32,000 of our best ideas.

In the files of Patent Offices around the world are over 32,000 active IBM patents. Although all of them can't be used by turning on one computer switch, most were developed to do one thing: put advanced technology at our customers' fingertips.

For example, IBM scientists and engineers pioneered every major innovation in disk storage and developed today's most advanced systems. These systems let users store the entire customer files of a medium-sized business in the space of a four-drawer file cabinet.

An IBM researcher invented dynamic random access memory (DRAM), the most widely used computer memory technology. DRAM





ON



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is incorporated in IBM's one-million-bit memory chips, the first of that density used in a computer. The world's fastest, most reliable chips, they retrieve information for customers in billionths of a second.

And IBM engineers invented the world's most sophisticated device for connecting and cooling computer circuitry. This helps increase speed and ensures reliability even when customers' computers perform many millions of computations per second.

Because IBM is committed to leadership in state-of-the-art technology, our customers can depend on us to offer more state-of-the-art solutions. That's IBM technology at work.



# Tapping into University Technology

*How to get to the R&D laboratory  
with the right stuff*

BY ELIZABETH AARON

**C**OLLAGEN CORP.'S success proves that connections can get you to the top. Two of Collagen's founders were Stanford University pro-

*Last month the concept of corporations forming joint ventures with universities to exploit research conducted by the latter was explored. The following article considers other avenues to tapping such productive research. If you missed last month's article, reprints are available for \$5 each from High Technology Business, 270 Lafayette St., Suite 705, New York, N.Y. 10012.*

fessors who developed a patentable technology that helps repair and restore body tissues. Stanford gave the professors the license to the technology in exchange for stock in their company. Although, initially, "Virtually all our revenues came from that [patent]," said Collagen president and CEO Howard Palefsky, the company continues to pursue research projects—most recently with Harvard University and the medical school at the University of California, San Francisco. Collagen reported \$20,357,000 in revenues for the first three quarters of this year.

The number of companies turning to universities for research is growing.



Katherine Ku, president of the Society of University Patent Administrators (SUPA) and associate director of Stanford's office of technology licensing, said the number of businesses and universities that belong to the society has grown from 70 to 500 in 15 years.

Ku attributes this growth to the Baigh-Dole Bill. Before 1980, the federal government owned all patents that





resulted from the university research it funded. Ku said that if a university wanted to own a patent, it had to cut through red tape to get a waiver from the applicable government agency. Ultimately, the government realized it was hoarding unused technology, she added, so the transfer act gave universities—whose research is usually 90 percent federally funded—first rights

to technologies they developed. Universities are then free to grant companies exclusive rights to patents.

Charles Gray, coordinator of new technology at ZymoGenetics, Inc., a Seattle-based biotechnology company, explained why his company is so interested in university research. He said there is more innovation in university research than in industry because, although nonacademic employees bring much to a company, they tend to lose some creativity over time.

University research also has a special appeal for companies suffering from a shortage of technical professionals. The manager of research planning at Monaca, Penn.-based Arco Chemical Inc., David Braunstein, said that when the company became independent from Atlantic Richfield last year, it had to rebuild its research base. Arco, which has worked with 50 universities in America, Europe, Japan and Great Britain, is forming a team of experts in different disciplines to bring technologies to the commercial sector faster.

Some companies have a track record of tapping into university research, others are less formal in their approach. For example, a company R&D executive may read a professor's paper, contact him or her and proceed from there to initiate formal negotiations. Attending academic and consortium meetings, conferences and symposiums and reading journals, studies, and papers are also ways of discovering new technologies waiting to be developed at universities. For those strapped for the time it takes to pursue such approaches, there are companies like University Science Partners Inc. (Detroit, Mich.) that act as agents to bring university technology to the commercial sector.

Most universities depend on business coming to them, but some have become almost entrepreneurial in the way they work with business—Stanford makes cold calls to business to license its patentable technologies. Technology transfer from universities to business is becoming a business for other universities as well. Many now have an office of technology licensing or technology transfer. And for some, business is so good that they have more than one. The University of California, which ranks fifth in the receipt of federal funding for university research, is establishing a technology transfer office at its San Diego (UCSD) campus to offset the load on its main office.

The University of Washington, which claims to be the public institution with the most federal funding, held its first science and technology exhibition last month—including biotechnology, sensing technology, biomedical instrumentation, advanced materials and image processing—solely to attract venture capitalists and business to see the technological ideas it has to offer. The university plans to make the exhibition an annual event.

It shouldn't be surprising that there are caveats for companies that are technology-hunting. Alan Kaganov, vice president of technical affairs at Baxter Health Care Corp., Deerfield, Ill., believes that pursuing the raw ideas offered by universities can have some drawbacks. Although universities do provide early access to a technology, other alternatives may get more commercially desirable results more quickly. Kaganov warned that a company must be selective in the technology it chooses to develop or it may not make back the money it sinks into the project. It can cost tens of millions of dollars for development, production and, if necessary, testing for Food and Drug Administration approval before a product reaches the marketplace. For example, he said, a company like Baxter can form a joint venture or strategic alliance with another company to exploit an already developed technology that may be more or more readily profitable.

Collagen's Palefsky said the whole purpose of working with universities is to beat the competition. It doesn't matter whether a company approaches a major university with a reputation for technical brilliance or a smaller university for the technological advantage, as long as the liaison makes the technology marketable.

Arco Chemical's Braunstein said that a solid agreement makes it easier for a company to work with a university over the extended period it usually takes to bring a technology to market; it gives a company the edge over its competition, and universities have become more savvy in their approach to legal agreements with the business sector. ZymoGenetics' Gray said biotech companies comprise the majority of those involved in legal agreements with universities. In the biotech industry, discovery is everything. Biotech companies have to move quickly to beat their competition to negotiating productive agreements with universities.

James Grant, chairman of T Cell Systems, Cambridge, Mass., which has worked with a number of institutions, said that in order to beat the competition when dealing with universities, it's important to bear in mind that a business and a university have different objectives: A university is interested in basic research and a business is interested in commercializing research. Initially, the edge over competition may not be as much in profit as in obtaining exclusive rights to a technology that a company can use in other products or license to other companies.

A close relationship with universities conducting research pertinent to a com-

pany's industry can help gain that edge. Interstate Electronics Corp., Anaheim, Calif., 97 percent of whose sales are to the military, is hoping that its connections with Johns Hopkins will help get it involved with a vision-research project through NASA. Johns Hopkins' Wilmer Eye Institute is already involved in the venture and Interstate is banking on its past dealings with the university to advance its participation.

Arco Chemical's Braunstein said that working with universities has helped it compete with foreign-owned, American-based companies. American companies lag behind foreign companies that are used to dealing with universities.

Arco Chemical has also found that having a rapport with universities gains it a positive recruiting image on campus, which helps it hire the best people the universities have to offer.

Companies familiar with the technology-transfer concept believe the money they have invested in developing basic university technology and gaining exclusive rights will in the end make them a profit. ZymoGenetics' Gray describes its experience with university technology as a "win-win situation."

*Elizabeth Aaron is a freelance writer and reporter for the Ipswich Chronicle in Ipswich, Mass.*

## TECHNOLOGY TRANSFER OFFICES

Following is a list of university technology-transfer offices, their directors and the technologies each university is best known for.

### Univ. of Calif., Berkeley

Patent, Trademark & Copyright Office  
1250 Shattuck Ave.  
Berkeley, CA 94720  
(415) 642-5000  
Director: Roger Ditzel  
biotechnology

### Univ. of Calif., Los Angeles

Patent, Trademark & Copyright Office  
1250 Shattuck Ave.  
Berkeley, CA 94720  
(415) 642-5000  
Director: Roger Ditzel  
biotechnology

### Univ. of Calif., San Diego

Patent, Trademark & Copyright Office  
1250 Shattuck Ave.  
Berkeley, CA 94720  
(415) 642-5000  
Director: Roger Ditzel  
biotechnology

### Univ. of Calif., San Francisco

Patent, Trademark & Copyright Office  
1250 Shattuck Ave.  
Berkeley, CA 94720  
(415) 642-5000  
Director: Roger Ditzel  
biotechnology

### Univ. of Colorado

Univ. of Colorado Foundation Inc.  
Office of Patents & Licensing  
Box 1140  
Boulder, CO 80306  
(303) 492-8134  
Counsel/Patent officer, John P. Holloway  
medical, optoelectronics, molecular biology, pharmacy, chemistry

### Columbia Univ.

Office of Science & Technology Development  
Director: Jack M. Granowitz  
411 Low Memorial Library  
New York, NY 10027  
(212) 280-8444  
biotechnology

### Cornell Univ.

Cornell Research Foundation, Office of Patents & Licensing  
East Hill Plaza  
Ithaca, NY 14850  
(607) 255-7367  
Director: Walter Haussler  
engineering, agriculture

### Harvard Univ.

Office for Patents, Copyrights & Licensing  
1350 Massachusetts Ave., Room 499  
Cambridge, MA 02138  
(617) 495-3067  
Director: Joyce Brinton  
biomedical, biotechnology, chemistry, material science, software

### Univ. of Illinois, Urbana-Champaign

Office of the Vice Chancellor for Research  
4th Floor, Swanlund Bldg.,  
601 E. John St.  
Champaign, IL 61820  
(217) 333-7862  
Associate Vice Chancellor, Dillan Mapother  
engineering, computing

### Johns Hopkins Univ.

Applied Physics Laboratory  
Johns Hopkins Rd.  
Laurel, MD 20707  
Director of Biomedical Programs:  
(301) 953-5000 x5258  
Chief of Technology Transfer, Space Dept.  
(301) 953-5000 x5100  
biotechnology

### Massachusetts Institute of Technology

Technology Licensing Office  
Room E32-300, 28 Carleton St.  
Cambridge, MA 02139  
(617) 253-6966  
Director: John Preston  
biotechnology, biomedical, ceramics, chemistry, computers, electro-optics, integrated circuits, polymers,

metallurgy, optics, semiconductors, sensors, signal processing, software

### Univ. of Michigan

Technology Transfer Center, Special Projects Div.  
College of Engineering  
2200 Banistee Blvd.  
Ann Arbor, MI 48109  
313-763-9000  
Director: Larry Crockett  
automated engineering

### Univ. of Minnesota

Office of Patents & Licensing  
1919 Univ. Ave.  
St. Paul, MN 55104  
(612) 624-0550  
Director: John Thuente  
health sciences, engineering

### Pennsylvania State Univ.

101 George Bldg.,  
306 W. College Ave.  
University Park, PA 16801  
(814) 865-6277  
Assoc. V.P. Sponsored Programs,  
Technology Transfer & Industrial Liaison: Dr. Kenneth J. Yost  
electronics materials, structural ceramics, polymers, manufacturing

### Univ. of Pennsylvania

Office of Corporate Programs & Technology  
Suite 300  
133 South 36th St.  
Philadelphia, PA 19104  
(215) 898-7293  
Director: George C. Farnbach  
biomedical

### Univ. of Southern Calif.

Office of Patent & Copyright Administration  
376 South Hape St., Suite 200  
Los Angeles, CA 90007  
(213) 743-4926  
Assistant Director: L. Kenneth Rosenthal  
medicine, chemistry

### Stanford Univ.

Office of Technology Licensing  
350 Cambridge Ave., Suite 250  
Palo Alto, CA 94306  
(415) 723-0651  
Director: Niels Reimers  
biotechnology, electronics, lasers

### Univ. of Texas at Austin

Center for Technology Development & Transfer  
College of Engineering, ECJ 2.516  
Austin, TX 78712  
(512) 471-3700  
Director: Stephen A. Szygenda  
biomedical

### Washington Univ.

Industrial Contracts & Licensing  
Campus Box 8013  
St. Louis, MO 63130  
(314) 362-5866  
Director: H.S. Leahy  
biotechnology

### Univ. of Washington

Office of Technology Transfer  
201 Administration Building, AG/10  
Seattle, WA 98195  
(206) 543-5900  
Director: Donald Baldwin  
biotechnology, bioengineering, engineering, medical applications

### Univ. of Wisconsin, Madison

The Wisconsin Alumni Research Foundation  
Box 7365  
Madison, WI 53707  
(608) 263-2500  
Director of Licensing: Thomas Hinkes  
pharmacy, life sciences

### Yale Univ.

Office of Cooperative Research  
252 JWG, Box 6666  
New Haven, CT 06511  
(203) 432-3003  
Director: Dr. R.K. Bickerton  
biotechnology, computer science, engineering



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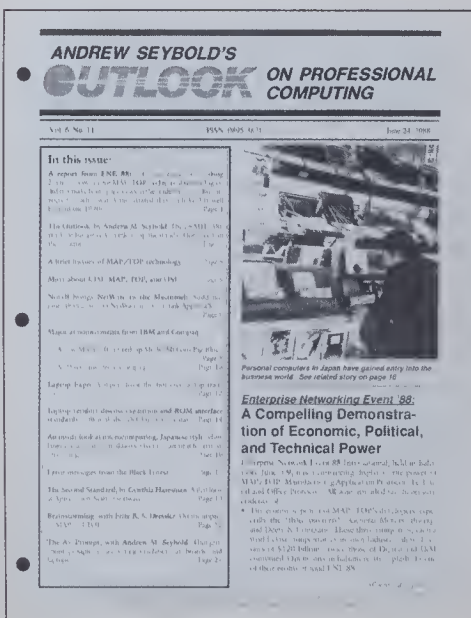
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# Newsletter Digest

Excerpts and expertise from newsletters covering the latest technological developments.

## AEROSPACE

C3<sup>1</sup>REPORT

### ICBMs to Use Solid-State Electronics

Air Force missile experts are looking as far as 20 years down the road toward guidance technology to be used in the next generations of intercontinental ballistic missiles (ICBMs). The effort is called the Advanced Guidance Technology Program and is being managed by the Charles Stark Draper Laboratory in Cambridge, Mass.

Strategic-missile guidance doesn't have to represent state-of-the-art technology—it's technology that has proven effective. The latest move in ICBM guidance systems is to use all-solid-state electronics, said a spokesman for the Air Force Ballistic Missile Office at Norton AFB in California.

Guidance systems in the Minuteman missiles now deployed at bases throughout the continental United States use a mixture of vacuum tubes and solid-state electronics, he said.

Designers want to use solid-state electronics to

build Vibrating Beam Accelerometers for future guidance systems. Experts are building air models so they can understand better how such equipment will work.

Another big concern for designers is making missile guidance systems that won't be fooled or destroyed by nuclear blasts or intense electronic interference, such as from high-power microwaves, said a spokesman for Draper Lab.

Much of the guidance work Draper performs for the Air Force is classified and officials are reluctant to disclose many details of their research.

Other areas Draper engineers are looking into are advanced inertial instruments, gyros and accelerometers. Draper officials are planning to hire subcontractors from Singer, Sunstrand, Litton, Delco, Texas Instruments, Harris, Raytheon, Microsemi and MRC to provide expertise in their research.

## SUPERCONDUCTIVITY

The Cambridge Report <sup>Re-0</sup> on

**SUPERCONDUCTIVITY**

### Top Three Compounds Get Attention

The periodic table of chemical elements is rapidly becoming a festive superconducting smorgasbord. Those who know their way around the table are having a feast.

Scientists and journalists who were beginning to bemoan a "slowing down" in superconducting research and development are now hard-pressed to keep up with the rapid-fire announcements of new materials.

Scientists are now working with three proven superconducting compounds: the original yttrium-barium-copper compound, a bismuth-based compound and a thallium-based compound—the

latter two discovered just this year. Moreover, a fourth compound based on indium is getting attention in some labs.

Scientists who have analyzed the rare-earth/copper-oxide compounds have found atomic structures based on copper-oxide planes that seem to characterize all the

### C O N T E N T S

<i>Aerospace</i> .....	30
<i>Superconductivity</i> .....	30
<i>Semiconductors</i> .....	31
<i>Energy</i> .....	32
<i>Manufacturing Automation</i> .....	33
<i>Computers</i> .....	35
<i>Materials Science</i> .....	37
<i>Fiber Optics</i> .....	39
<i>Lasers</i> .....	40



validated oxide superconductors. The researchers are now substituting elements to replace the expensive rare earths or poisonous thallium.

Here is a rundown of the latest materials getting attention as superconductors:

**1. The bismuth-based compound.** This mixture of bismuth, copper, strontium and calcium was discovered nearly simultaneously in Japan and the U.S. Initial reports claimed Tc (the superconductivity temperature) at 114° Kelvin to 120° Kelvin—a clear improvement over the 1-2-3 compounds in which the best Tc was 90° Kelvin.

Researchers have since discovered that the bismuth compounds start to become superconducting at 120° Kelvin, but reach actual zero resistance at between 90° Kelvin and 100° Kelvin. They have discovered advantages and disadvantages compared with the 1-2-3 compound.

On the plus side, researchers at both AT&T's Bell Labs and Superconductor Technologies Inc. of Goleta, Calif., said that critical current capacity of the bismuth-based material appears to be higher than the yttrium-based compound. Both organizations declined to provide figures, saying that their results are thus far inconsistent. Said an AT&T researcher: "Here's reason for optimism that there may be ways to deal with [the bismuth material] and get high critical current wires."

Much uncertainty still exists about current-carrying capacity. Some initial work showed it to be

only 250 Angstroms per square centimeter in bulk samples, which is lower than the capacity achieved in the 1-2-3 compound.

On the down side, the material is inconsistent from batch to batch, though Superconductive Components Inc. of Columbus, Ohio, has improved reproducibility by adding 6 percent lead to the bismuth compound. The AT&T researcher said that superconduction sometimes occurs at 80° Kelvin and sometimes up to 120° Kelvin, apparently because of very subtle differences in composition.

**2. The thallium-based compound.**

Allen M. Hermann and Z.Z. Sheng of the University of Arkansas in Fayetteville substituted thallium for bismuth and achieved true Tc at 106° Kelvin in late January. IBM researchers achieved true Tc at 125° Kelvin by using optimum proportions of thallium, calcium, barium, copper and oxygen.

On the plus side, the thallium compound is very easy to reproduce and fabricate. On the other hand, the thallium compound is a deadly poison and some researchers won't allow it in the door.

**3. The indium-based compound.** Rumors that Alex Muller of IBM was preparing to present a paper on a superconductor substituting nontoxic indium for thallium had several labs and companies preparing samples. In its unfilled outer ring of electrons, indium is identical to thallium. Consequently, indium may offer the superconducting performance of thallium without the danger.

## SEMICONDUCTORS

### SEMICONDUCTOR ECONOMICS REPORT

#### Raw Materials Drive Up Memory Board Costs

It upsets your market plans when the raw material cost is suddenly three or four times higher than the budget. The market prices of DRAMs have been a major issue for many systems manufacturers in 1988. Companies such as Digital Equipment, Hewlett-Packard, Intelligent Systems, Sun, AST and others have either delayed product releases or have increased prices by as much as 25 percent.

The companies that are really in trouble are those that had only short-term or no purchase contracts on DRAMs. These manufacturers are either holding production or paying spot prices, which are now five to ten times above the expected values, based on historical trends.

The math is simple. The purchased cost of the DRAMs for most of the memory board products is typically 10 to 20 percent of the final market price. With the present contract prices per bit running at least three times the expected trend, the manufacturers' cost has increased between 20 and 40 percent. As Hewlett-Packard indicated, "We have tried to hold the line on increases, but the drastic wholesale price jumps on DRAMs forced us to pass along some of our increasing costs."

It is interesting to note that almost all users indicate that DRAMs are available. There is no shortage if the user is willing to pay the going spot price. This availability is also evidenced by the numerous catalog sales advertisements in the back

of most electronic publications.

Product planners have had three unexpected problems. First was the artificially induced price increases based on the U.S. government's view of "Fair Market Value" (FMV) and anti-dumping. The immediate effect was to double the price of the 256K DRAM. Japan's method of responding also compounded the problem. Many of the Japanese companies were able to lower their FMV and become more competitive by not adding capacity and by running existing facilities at full capacity. Additionally, with the expected crossover to the 1 Meg design in 1988, any new capacity and investment were allocated to that product. As a result, according to MITI, Japanese production of 256K parts peaked in the first quarter of this year at a rate of 160 million units per quarter. This, coupled with the increasing demand for memory for the new computer families (about four times the number of bits as required by the old PCs), has resulted in prices of "what the market will bear."

It should be noted that the cost of manufacturing the devices has continually decreased. A fair market

price would now be in the range of \$1.50 to \$2, or as low as 0.6 millicents per bit.

The second problem faced by the system manufacturers is the delay in the volume availability of the 1 Meg device. If the worldwide semiconductor industry had followed historical trends, the 1 Meg device would have been in sufficient production and available at a lower market price per bit than the 256k units in mid-1988. Manufacturers would not still be putting the less cost-effective 256k parts on boards. Again, it should be noted that the cost of processing the 1 Meg units has been dropping. The resultant fair market price would now be less than \$8.

The third problem is more long-term. The system planners and designers must now realize that the old 33 percent trend line no longer holds even with a balanced market place. As discussed in SER (December 1977), the industry has lost the learning curve because of both the increasing complexity of the designs and the manufacturing costs. The new annual price decline probably will average out in the range of 20 to 25 percent on future DRAM products.

## **ENERGY**

### **Coal & Synfuels Technology**

#### **Slurry Fuels Could Increase Coal Use**

Mixing lime with slurry fuels containing medium-sulfur coal could enable a generating unit to carry up to 70 percent of its rating while complying with sulfur-dioxide emission limits. Barring a sharp drop in world oil prices, burning such slurry fuels could offer a flexible approach to expanding coal use, a consultant told a recent conference in Washington.

Uncertainties remain, however, said Shashank Nadgauda of Renova Engineering P.C. in New York. There is no reported data on the preparation or use of coal-lime-water slurry (CLWS) fuels. But there's enough evidence to suggest that CLWS could represent a cost-effective approach to commercializing slurry fuels.

As traditional coal-water slurries have lost their appeal because of low oil prices, dry sorbent injection for SO<sub>2</sub> control has shown increasing promise, said Nadgauda. Recent tests indicate that hydrated lime injection in coal-fired furnaces can remove up to 50 percent of the SO<sub>2</sub> emissions.

With the renewed interest in calcium-based

sorbent injection has come data that, under the best conditions, 40 to 60 percent of SO<sub>2</sub> can be captured with dry hydrated lime as the sorbent, Nadgauda said. But key factors play a role in the effectiveness of that process: Finer sorbent particles (1 to 10 microns) are needed to improve SO<sub>2</sub> capture, proper dispersion of the sorbent particles in the flue gas stream is necessary and the location of the sorbent injection makes a major difference.

Current R&D efforts are aimed at injecting sorbent in the flue gas at 2,300° Fahrenheit and capturing SO<sub>2</sub> as the flue gas temperature drops to 1,600° during its passage through the boiler. Any deposition on boiler tubes could be managed by proper selection of soot blowers and coal ash properties, Nadgauda said. In addition, disposal of the spent sorbent and fly ash doesn't pose any big environmental problems.

Pulverizing coal and lime, then mixing them with water to produce a slurry is, so far, only conceptually possible, with much data still lacking, Nadgauda said.



Similarly, injection through the burners will provide a better dispersion and longer residence time as the flue gas passes through the boiler. This should improve the SO<sub>2</sub> capture beyond the 50 percent level projected for the dry hydrated lime injection technology, said Nadgauda.

As long as the use of CLWS fuels is limited to 60 to 70 percent of an oil-designed boiler's rating, there will not be any major impact on steam generation, Nadgauda said. But the presence of water in the slurry could decrease boiler efficiency by 2 to 4 percent.

Findings suggest that slurry fuels made from "proper" quality coal, lime and water show potential for renewed efforts to commercialize

CLWS fuels because the need for SO<sub>2</sub> scrubbers would be eliminated, Nadgauda said.

While the results of further technical work and an analysis of site-specific issues are necessary to estimate the economics of conversion, a plant could use CLWS fuels with medium sulfur content to meet 60 to 70 percent of its load while complying with the required SO<sub>2</sub> emissions standard.

If the SO<sub>2</sub> emissions criteria became more stringent, the plant could switch to CLWS fuels made with lower-sulfur coal, Nadgauda said. This could be done, he added, by changing the feedstock coal or by cleaning the coal. "There will be a trade-off because deep beneficiation could eliminate the need for lime in the slurry fuels," he said.

## MANUFACTURING AUTOMATION

### The Network is the Factory

As we all know, Digital Equipment Corp. was one of the first computer vendors to perceive the need for enterprise-wide communications in corporate America. To tell the world of its great insight, Digital came up with the slogan "The network is the system." At about the same time, newcomer Sun Microsystems announced that it too saw a networked future and, further, that in its vision, "The network is the computer."

Network wisdom is now common wisdom. Even IBM is pushing its grand old SNA design through yet another reincarnation—the peer-to-peer SAA reincarnation. Chairman John Akers has fearlessly stated that "transparent access to remote data" is now required, and is among the company's top three R&D priorities.

But here's the key question: Are the established reservation and order-entry systems the ultimate expression of networked perfection for corporate America? Or, to ask it another way: What will all the new networks of the 1990s connect to, and what will they do?

For me, the recent ENE 88i (Enterprise Networking Event '88 International) conference in Baltimore gave the answer. The next generation of networks—the open generation built on Open Systems Interconnection (OSI) standards—will revolutionize the production of goods worldwide. These networks will lead to and from all factory

floors around the world.

Why? Because that's where the big payoffs will be, the places where more human knowledge will be turned into more useful products than anywhere else. In short, "factory floors" are the places where the big wealth will be made.

But the "factory floors" will not be where they used to be; in fact, they won't even be what they used to be. Manufacturing Automation Protocol/Technical and Office Protocol (MAP/TOP) will change everything. From now on, economic value will be added in the MAP/TOP networks themselves, not on any traditional factory floors.

The MAP/TOP duo is the heart of all preproduction technologies in the next industrial age now taking shape worldwide, the so-called CIM (computer-integrated manufacturing) age. MAP and TOP are two distinct networking schemes, but, by deliberate design, they work together and share five layers (layers 6, 5, 4, 3, and 2) of the seven-layer OSI architecture.

TOP is aimed at engineering and business activities; its CIM partner, MAP, is designed to tie into and control activities on the factory floor. To best perform their diverse roles, MAP and TOP remain distinct and specialized at OSI layers 7 (the application layer) and 1 (the physical layer).

TOP's development and use parallel those of the pre-press systems already available in the publishing industry—a desktop-based and network-oriented

ANDREW SEYBOLD'S  
**CUTLOOK**  
ON PROFESSIONAL COMPUTING

group of technologies to both create and share information. In other words, in full-blown CIM, all industrial processes closely resemble publishing processes; and, as in the publishing industry, by far the greatest part of all value added is in the creative preproduction part. MAP extends the information streams to the automated machines on the factory floors. In CIM, the counterparts to the printing presses are computer-controlled devices of all kinds used to shape and handle physical products. And, just as in publishing, the formerly fragmented and specialized processes of the old industrial age are integrated into a cooperating whole, independent of physical location.

Already, Boeing, the prime mover behind TOP, uses integrated design/build teams instead of design and build teams as before. And, even more telling, Boeing refers to its MAP/TOP networks as "enhanced information systems" and places them at the core of its total CIM effort. General Motors, the big mover behind MAP, currently has 12 facilities under MAP, and another eight facilities going under MAP.

Worldwide, there are now about 100 known installations using MAP and about a dozen using TOP. Virtually all these installations are world-class competitors, including the likes of BMW, Deere & Company, British Aerospace, Ford, Eastman Kodak, Du Pont and Lockheed. There are more MAP/TOP installations, but many companies are reluctant to talk about them for competitive reasons.

MAP/TOP is a tidal wave in the United States: The top 10 U.S. companies moving into MAP/TOP alone have combined yearly sales of over \$350 billion; that's seven times as great as IBM's yearly sales. Small wonder that Helen Hancock, IBM VP and GM, Communications Systems, the top communications manager at IBM, said publicly at ENE 88i that OSI will become a subset of SNA. And she said so looking boldly into the TV camera during an interview with Bear, Stearns & Co., the Wall Street brokerage firm. Bear, Stearns had most of the major players in front of the camera during a taping session at ENE 88i, including Digital Equipment, Hewlett-Packard, Unisys, NCR, Apple, and Sun—and all took the OSI pledge in public.

In addition to all that, the U.S. government has issued its GOSIP—Government OSI Profile—requiring OSI standards in the 1990s. In GOSIP, the government has virtually committed its \$300 billion

per year defense procurement budgets to companies that favor MAP/TOP systems.

How about the rest of the world? If anything, the industrial leaders in Europe are one or two years ahead of their U.S. counterparts. And the Japanese are somewhere in between their rivals in Europe and the United States.

ENE 88i provided demonstrations of MAP/TOP 3.0, the latest version of that combined preproduction technology. Applications had been previously tested in the United States or in Europe, and they all worked. Many were more flexible and more powerful than proprietary networks.

There is now a six-year compatibility freeze on MAP/TOP; all applications and improvements for the next six years will be compatible with MAP/TOP 3.0 today.

MAP 3.0 incorporates a sleeper technology called MMS, or Manufacturing Message Specification. This is the most incredible technology of all, a very robust MDL—manufacturing description language—with the power to revolutionize factory floors. MMS is a software revolution within a MAP/TOP communications revolution.

Think of MMS as an industrialized and networked variant of the PostScript page-description language (PDL). Whereas PostScript describes images for publishing, MMS is an MDL that describes the handling and shaping of products in manufacturing. No matter what the devices are on the factory floor—robots, machining devices, or assembly devices—and no matter which vendors made them, a product designer can interface all of them using MMS.

Another way to think of MMS is as an industrial version of PostScript combined with CL/I, the communications language from Network Innovations. MMS-equipped automatic devices in manufacturing networks are the parallel of PostScript-equipped printing devices in publishing.

Think for a moment about MMS's potential impact on manufacturing. First, there's TOP to help create and share design information in a multivendor environment; then there's MAP to take the electronic information onto the factory floor and produce useful goods—all in one enhanced information stream. With MMS, the same software can drive similar industrial devices from any manufacturer. In CIM, the magic of computers is used to design and manufacture products with machines anywhere around the world.



The networked future beyond MAP/TOP 3.0 can already be discerned. I see it this way:

The handful of leaders in each industry in each country will not only adopt MAP/TOP 3.0, they will also use it in building extensive private communications networks to tie together their customers and suppliers. These networks will have fiber backbones and fiber ribs, and they will be based on OSI standards, including ISDN in the lower layers. Most important, these networks will make end runs around both the traditional phone companies and the first-generation, mainframe-based proprietary systems. These manufacturing-related networks are the key networks of the future.

To get maximum effectiveness, the industry leaders will require that suppliers and customers adopt MAP/TOP technology. And to help everyone out, the leaders will make available full OSI (network) services at very low cost. Like the airline reservation systems of today, these new strategic networks will grow to become more important than the manufactured products.

The MAP/TOP/CIM bottom line: The industrial leaders around the world are in a competitive race, and they know the first ones to secure the full advantages of CIM—across customers, the enterprise itself and suppliers—will win. The winners will be the new industrial age.

## COMPUTERS

**COMPUTER**  
*Daily*

### Optical Processing Makes Progress

A new report describes current research in the optical processing of data at NASA's Ames Research Center. The research is prompted by plans for automation systems for use on the proposed Space Station; in particular, an optical pattern-recognition system that can be developed into robotic-vision and spectral-analysis systems and an optical processor for control of the wave front of an adaptive mirror experiment. These optical processors would offer several advantages over electronic systems with similar capabilities, including an optimum match for optical input, low power consumption, and reduced cost, size and weight.

The classifier type of pattern-recognition system performs three operations: extraction of features, reduction of dimensionality, and classification. A feature extractor must be able to function in the presence of such distortions as changes in scale, rotation, changes in focus, and blur. A feature extractor might organize a set of descriptors (e.g., color, curvature, elongation, geometric moments, length, width, and area) into a feature vector. The feature vector is useful because it transforms an image into a point in feature space. Typically, such a space has more than 50 dimensions, and it is preferable to reduce the dimensionality to less than five. Classification can then be performed by comparing the reduced feature vector with test data to identify the object.

The report describes an advanced optical feature

extractor that would perform the Fourier-Mellin transform to generate a feature vector that is invariant under changes of scale and position and that responds to rotation with a simple translation. The Fourier-Mellin feature vector facilitates the reduction of dimensionality by means of the Fourier transform and variation of the resolution of the detector array in the processor. Classification must still be performed electronically.

A proposed correlator type of pattern-recognition system that would involve (a) synthetic discriminant functions that can be made invariant under distortions of scale, translation, rotation and class and (b) matched spatial filters that insert the reference images corresponding to the discriminant functions, for correlation with the scene. The matched spatial filters are Fourier-transform images generated by computer and written to a magneto-optic spatial light modulator. The system would have to be "trained" by a human operator.

The mirror/wave-front control problem has elements in common with efforts to control other high-dimensional dynamic systems. The report discusses candidate digital and analog architectures for the optical execution of state-estimation algorithms that arise in such problems. The system chosen for demonstration includes a segmented, adaptive mirror and a point-diffraction interferometer. The interferogram is sensed by a video camera and processed to yield the state estimate and control signals.

### NEC Creates 50 Megabyte Floppy Drive

Nippon Electric Company has developed a vertical-recording 3.5-inch floppy disk head using a cobalt-chrome alloy as the coating material. NEC noted that the floppy disk can record data at a very high density of 50 megabytes and that its durability of more than 30 million uses (recording or playback) is comparable to the life spans of conventional horizontal-recording disks. Also, the technology is not a prototype development but is ready for commercial application. NEC will have the new floppy disk on the market in two to three years.

Both sides of the disk are usable, according to the researchers.

Vertical recording is a new data recording technology that deploys tiny magnetic materials in a vertical direction instead of the conventional horizontal direction, as with normal floppy disks. Theoretically, the vertical-recording bits give more than 10 times the recording density of conventional disks that have the bits arranged horizontally in relation to the disk surface. However, because the recording film is so thin (0.3 microns), the slightest surface scratch will affect the disk's performance.

## Advanced MILITARY COMPUTING

### DARPA Research Focused on Computing

The Defense Advanced Research Projects Agency (DARPA) plans to spend \$126 million on high-performance computing technology next year. DARPA's Strategic Computing Initiative program plans to demonstrate: monolithic integration of a gallium arsenide (GaAs) laser diode and a silicon integrated circuit; a heterogeneous multiprocessor system and a New Generation System (NGS) vision system; high-density packaging of integrated circuits with a 40 megahertz silicon processor; a 2,000 word continuous speech recognition system; optical links in the Connection Machine supercomputer; the Airland Battle Management system; and JANUS-II, a natural language interface.

These technologies, which include both hardware

and software development, compose the base of the Pentagon's thrust in advanced computing technologies. One artificial intelligence project the agency is pursuing is the Capabilities Assessment Expert System (CASES).

In Air Force work, DARPA is to demonstrate near-real-time performance of the Pilot's Associate computer system, a net of linked expert systems for advanced cockpits of future airplanes. In computer vision, DARPA plans to transfer the Strategic Image Exploitation testbed to an operation facility for demonstration and technology evaluation.

Advanced parallel computing architecture is one of the most promising new technologies in high-performance computing, according to industry and government research plans.

### IBM Prepares for PROFS wars

IBM's PROFS (Professional Office System) software will drive users to embrace the OS/2 operating system faster than anything else—and the PROFS wars have begun in earnest. IBM has indicated that it is working on an OS/2 version of PROFS, and Microsoft is known to be trying out some ideas as well. Meanwhile, Lotus is also after

this market in a big way, with Agenda and some add-in and add-on products.

Another company that's doing exciting work in this area is Coordination Technology, Inc. (35 Corporate Drive, Trumbull, CT 06611; 203 268-4045). CTI has signed a letter of intent with Digital Equipment Company; the plan calls for DEC to market CTI's as-yet unnamed program.



### **Fiber Optic TV Trials Take Key Step**

Bellcore announced that its national field trial of a fiber-optic-based digital television transmission system took a major step forward when trial participants recently agreed to the use of signal-coding algorithms.

That agreement clears the way for the trial, scheduled for the summer of 1989. It will involve broadcasting by the major networks, ABC, CBS, NBC, Fox and PBS, over a fiber-optic network linking eight cities: Boston, New York, Washington, Atlanta, Indianapolis, St. Louis, Minneapolis and Los Angeles. Each network will use the trial system for a three-month period during the 15-month trial.

Five interexchange carriers will provide the long-distance fiber links. They are CNI, Lightnet, SouthernNet, Norlight and Witel. The seven Bell regional holding companies will provide local fiber connections.

The U.S. trial, and a similar effort involving Bell Canada and the Canadian Broadcasting Corp., will test using a land-based fiber-optic system to carry DS3-rate digital video signals. Broadcast networks currently depend on analog satellite systems to broadcast their own programs and to collect material from remote locations and local affiliates. But, according to Bellcore's district manager for digital audio, video and radio, Robert Blackburn, a land-based fiber-optic system could provide lower-

cost, higher-quality distribution networks. The digital system, which permits simultaneous two-way transmission, would also be less vulnerable to signal theft than satellite broadcasts. It would open the door to new applications and to more extensive use of private video networks for teleconferencing by business users and for educational programming.

At a forum last fall in Los Angeles, Bellcore presented its technical advisories on codecs to allow all manufacturers' equipment to function compatibly on a multi-channel network, and for a multi-point unit to control and reconfigure a network. The codecs are used in converting analog broadcast signals to digital mode for transmission over single-mode fiber.

Trial participants have now agreed that coding algorithms demonstrated by both NEC and Telettra provided acceptable quality. The group also agreed that broadcasters and suppliers will be free during the trial to test other signal coding algorithms.

In addition to NEC and Telettra, 10 other equipment suppliers have signed up to participate in the trial, providing video codecs, audio codecs, multipoint units, and controller and test set hardware. The suppliers include ABL Engineering, AEG Bayly, Anritsu America, Coastcom, Comlux, DSC Communications, Northern Telecom, RE Instruments, Tau-tron and Teling.

## **MATERIALS SCIENCE**

### **New Membranes Developed for Industry**

Membranes have found wide acceptance in the traditional chemical and petroleum refining industries and are finding a new role in the rapidly developing specialty-chemicals industries where highly selective catalysis is essential and where catalyst use must be intimately combined with pre- or post-reaction preparation and separation.

Among the reasons for the interest in membrane technology for high-volume separations is energy economy. The abrupt increase in energy costs in the 1970s decreased the appeal of cryogenic, thermal and absorption processes. Membranes now available may be simple, compound, non-polar, bipolar,

neutral anionic or intrinsically catalytic, among others. Their use can be prescribed within broadening limits and they are being employed both alone and in combination with existing types of separators.

Membranes have found high-volume industrial applications in several major separation areas, including gas-mixture separations, desalination and high-purity water production and waste treatment. In gas separation, one of the more significant uses is recovery of hydrogen from refinery streams for recycling. Other uses include the removal of carbon dioxide and hydrogen sulfide from natural gas, production of nitrogen and enriched air, recovery of

## **INDUSTRIES IN TRANSITION**

methane from mines and landfills and recovery of certain gases from exhausts.

For desalination and regeneration of brackish waters, there is currently more of an international demand for this technology than in the United States, although one of the more celebrated examples of treatment of brackish water has been the regeneration of the Colorado River to acceptable composition before it exits the United States.

In the area of waste treatment, much attention is being given to the processing of pickling acids and electrochemical plating solutions. These applications are among the most demanding for membranes.

From a marketing standpoint, the market for membranes and membrane technology is now about \$750 million, and it should grow at a rate of between 10 percent and 15 percent per year. Gas separations systems are the major growth area. The market for gas separations is projected to easily reach \$1.5 billion by 1995.

This market growth includes the market for air

separation by membrane systems, which could total \$600 million by 1995. Principal applications would be to produce enriched air for combustion and high-purity nitrogen for blanketing and use as an inert medium.

A second area of development would be separating carbon dioxide from natural gas. The two major applications in this area would be sweetening pipeline gas and recovering carbon dioxide for reinjection in tertiary oil recovery. This market could reach \$100 million by 1995.

The largest market for membrane gas separations is in recovery of hydrogen from process streams in refineries and chemical plants. The world demand for hydrogen could double by the year 2000 and that demand for hydrogen separation systems could provide a market of \$800 million annually.

Desalination by reverse osmosis currently accounts for water-generating capacity of about one billion gallons per day. The largest single capacity is a new plant in the Middle East that has a capacity of 12 million gallons per day.

### **Cablers Envision Multi-standard HDTV Sets**

A "multi-standard receiver" designed for a "family of HDTV transmissions" may be necessary to receive programs from broadcast, cable and VCR sources, according to engineers of Time Inc.'s ATC and HBO. This speculation falls somewhere between proposals that all HDTV systems be mutually compatible and the "open architecture" concept requiring that sets be capable of receiving any method of transmission.

ATC and HBO are quick to add that any system should use "scan rates and other parameters that allow reasonably priced multi-standard NTSC/HDTV TV sets to be produced." They define a multi-standard set as one that readily interfaces "with all TV formats it will be expected to receive, [including] NTSC, C-HDTV (cable), VCR-HDTV and broadcast EDTV." Why separate systems? "Each distribution medium must be allowed to deliver the best possible HDTV service it is capable of delivering. This may imply a family of HDTV transmission standards with a corresponding multi-standard HDTV receiver."

This view of HDTV is contained in a paper by ATC's William Thomas and HBO's Paul Heimbach at a recent International Conference on Consumer

Electronics (ICCE) in Chicago. The authors warn against development of HDTV technology by "manufacturers or agencies not sensitive to cable's needs," which could "ultimately result in the same kind of incompatibility problems we as an industry experienced with 'cable-ready TVs,' connection of VCRs in scrambled systems and delivery of BTSC-MTS stereo." Co-author Thomas told us that he didn't endorse open architecture, but the concept had some adherents at Time Inc.

Attributes that will be considered for a cable HDTV system" (C-HDTV), according to authors, are:

- At least 850 lines of horizontal and vertical resolution in both static and moving images.
- Occupancy of one 6-MHz RF channel—"cable does not generally have significant available bandwidth, nor is it electrically transparent to the signals it is carrying."
- Need for "little or no rebuild" of typical cable system.
- Ability to coexist with other channels on cable, not requiring "redefinition of the cable channelization plan," to permit any number of NTSC channels to be replaced by C-HDTV channels.
- "Hooks" to allow future evolutionary

## **TELEVISION DIGEST**



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however. The Department of Defense (DOD) and the avionics industry are expected to play the greatest roles in the market. IDOCS sales are expected to reach \$10 million by 1990, from an installed base of zero.

In perimeter defense, fiber run through a mesh fence, barbed fiber tape, or fiber wall paneling can access. Buried fiber fences serve as deterrents in the protection of pipelines. Using dedicated electronics

An intruder must first strip a cable to expose the fiber and then deflect some of the transmitted light into an intruder receiver.

On the brighter side, however, fiber can detect a tap in the form of an optical power loss, and a fiber link can be designed to sound an alarm or to shut down automatically upon the detection of a tap.

Government communications, whether transmitted via copper or fiber, still mostly depend

methane from certain gases.

For desalinating waters, there is a demand for the States, although there are examples of the regeneration of acceptable conditions in the States.

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#### Cablers Envision

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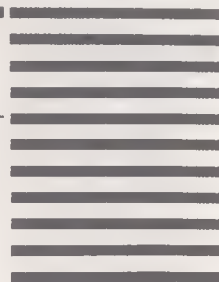
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improvements, on the assumption that "technological improvements over the next 10 to 20 years will allow even better HDTV signals [than] C-HDTV."

- Accommodation of real-time, live HDTV programming without bandwidth compression or conservation techniques requiring non-real-time processing.
- Easy interface with an SMPTE-approved 1,125/60 HDTV production system.
- Four CD-quality audio channels.
- A "built-in" high-security audio and video scrambling and addressing system.
- Ability to be delivered by satellite to a variety of receive locations.
- Recordable on consumer and professional VCRs and optical discs.

The authors note that ATC is funding two HDTV research and development efforts. The first is

through the Center for Advanced TV Studies (CATS) at the Massachusetts Institute of Technology (MIT) "to determine the feasibility of the C-HDTV transmission system" described in the paper. This is expected to take two years, producing computer simulations by the end of the first year and "implementation designs" by the end of the second.

The second effort involves the David Sarnoff Research Center "to ensure that ACTV is compatible with satellite and cable distribution." Asked about the possibility of achieving all of the stated requirements within a single 6-MHz channel, Thomas said that that was the aim, and expressed hope that "75 to 90 percent of goals" could be achieved. "A lot of knowledgeable engineers say we'll be able to do a lot more in years than we think we can do now," he said.

## **FIBER OPTICS**

### **New Fiber Optic Use: Security**

Lightwave has two major security applications: keeping intruders out of a building, military base or other sensitive areas, and protecting communications links from being tapped. Both uses are significant, but there is disagreement on which will prove most important in time.

According to Plexcom Inc., the use of fiber as a sensing barrier, rather than in communications, promises the largest number of major new developments. However, Hughes Aircraft Co.'s Microelectronics Division has committed itself to the sale of secure communication systems.

The Air Force has already awarded four contracts (worth a total of \$2 million) for advanced intrusion-detection systems (IDOCs). This is only the beginning of the market for IDOCs-type devices, however. The Department of Defense (DOD) and the avionics industry are expected to play the greatest roles in the market. IDOCs sales are expected to reach \$10 million by 1990, from an installed base of zero.

In perimeter defense, fiber run through a mesh fence, barbed fiber tape, or fiber wall paneling can access. Buried fiber fences serve as deterrents in the protection of pipelines. Using dedicated electronics

also makes it possible to locate a break in a fence, even if the fence is up to 100 kilometers long. According to Alan Pocrass, marketing manager of Plexcom, oil pipeline security is a major potential use for the systems.

Some systems employ fiber that contains a reference beam of light from a light-emitting diode, which acts as a microbend pressure sensor. Any intrusion will be sensed by the fiber as a microbend, changing the frequency of the light and activating an alarm. In simpler applications, fiber relays signals that pressurized cable has been ruptured.

Unfortunately, fiber of any length is tappable. Only about .001 percent of the total power output of an unencrypted data stream is needed to gain access to the information. Although getting information involves several steps, it is not difficult. An intruder must first strip a cable to expose the fiber and then deflect some of the transmitted light into an intruder receiver.

On the brighter side, however, fiber can detect a tap in the form of an optical power loss, and a fiber link can be designed to sound an alarm or to shut down automatically upon the detection of a tap.

Government communications, whether transmitted via copper or fiber, still mostly depend

**FOS<sup>2</sup>**  
Fiber Optic Sensors and Systems

on encryption. The DOD's fiber installations presently carry encrypted data. According to the National Security Agency (NSA), the safest way to transmit sensitive government data over fiber is to send encrypted data over a system protected by IDOCS. An intruder would be unable to get even a third of the data needed to make sense of a message before a more advanced IDOCS sensed the tap and shut itself down, says Thomas Cosco, marketing

manager for IDOCS at Hughes Microelectronics.

The United States military has been a key party in the drive for secure lightwave voice and data networks, with the NSA playing a major role in their application. Securing local-area networks (LANs) is expected to become a major lightwave application, but the incorporation of fiber-optic intrusion-detection and intrusion-resistant subsystems into LAN designs is still in the future.

## **LASERS:**

### **Breakthrough Means Smaller Solid-State Lasers**

Asahi Glass Company has developed a solid state laser device using a laser diode as the light source excitation system. Replacing the conventional electrical discharge lamp as the excitation light source has markedly reduced the size of the solid state laser system and also solved the heat problem. The yttrium aluminum garnet (YAG) laser emitting the light absorbs about 100 percent of the excited

light. The conversion to light was enhanced from 1 percent efficiency to 15.5 percent, which contributed to a considerable reduction in heat.

The new solid state laser can be used as a pickup device in optomagneto disk systems, optical measuring instruments and optical communication systems. The price of the system, including the power source, is about \$7,692, about one-tenth the cost of available solid state lasers.



**TEC REPORT**

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# MARKETWATCH

## CONTRACTS AWARDED

AWARDED TO	AWARDED BY	AMOUNT	PURPOSE
Advanced Technology Materials 520-B Danbury Rd. New Milford, CT 06776 (203) 355-2681	Defense Advanced Research Projects Agency	\$950,000	To develop a process to manufacture thin films of high-temperature superconductors for use in microwave sensors and as connectors for logic and memory computer chips.
Central Maine Power Edison Drive Augusta, ME 04336 (207) 623-3521	Keyes Fibre	\$2 million	To sell electricity released by efficiency improvements through the "Power Partners" program.
Churchill Communications 500 Eighth Ave. New York, NY 10018 (212) 563-5000	Fannie Mae	Not disclosed	To provide an electronic mail-based on-line reporting system for lender servicing institutions in the Fannie Mae Multifamily Loan Program.
Cantel ASC 15200 Omega Dr. Rockville, MD 20850 (301) 590-7222	SITA	Not disclosed	To provide on-demand satellite services for SITA's data traffic between New York, Georgia and California.
Cantel Federal Systems 12015 Lee Jackson Hwy. Fairfax, VA 22033 (703) 359-7500	U.S. Air Force	\$30 million	The Applied Systems division will design, install and integrate the relay-node network expansion of the Ground Wave Emergency Network.
Cantel Federal Systems 12015 Lee Jackson Hwy. Fairfax, VA 22033 (703) 359-7500	U.S. Army	\$16.5 million	To operate, maintain, install and repair administrative telephone systems for the Mid-Atlantic region (MARATS).
Cullinet Software 400 Blue Hill Dr. Westwood, MA 02090 (617) 329-7700	United Building Society	Not available	To provide a computer-based banking system.
Eda Corp. 14-04 111th St. College Point, NY 11356 (718) 445-6000	U.S. Naval Sea Systems Command	\$8.7 million	The Government Systems division will provide AN/SQR-18 Improvement Kits and Systems. The AN/SQR-18 is a sensor system used to detect submarines at long range.
Ericsson 100 Park Ave. New York, NY 10017 (212) 685-4030	Mexican Government	\$230 million	To provide Mexico's 1990 telephone network expansion program with the AXE digital-switching system and transmission and power equipment.
Harman Industries P.O. Box 1570 Blue Springs, MO 64015 (816) 229-3345	N.Y. Rail Car	\$2 million	To manufacture and supply cab-signal and automatic train control equipment.
Harris Corp. Melbourne, FL 32919 (407) 727-9100	U.S. Air Force Air Logistics Center	\$25 million	To supply mobile radio-communication systems for ground-to-air and point-to-point long-distance communications.

## CONTRACTS AWARDED

AWARDED TO	AWARDED BY	AMOUNT	PURPOSE
Infotron Cherry Hill Industrial Center-9 Cherry Hill, NJ 08003 (609) 424-9400	Hughes Aircraft	\$1.2 million	To provide NX4600 Network Exchanges to be used by Hughes Aircraft for its development of a voice and data networking facility as part of the SDI program.
Integrated Measurement Systems 9525 S.W. Gemini Dr. Beaverton, OR 97005 (503) 626-7117	National Semiconductor	\$2 million	To provide Logic Master XL prototype verification systems for production testing of National Semiconductor's ECL gate arrays.
Integrated Measurement Systems 9525 S.W. Gemini Dr. Beaverton, OR 97005 (503) 626-7117	Star Technologies	\$250,000	To supply the Logic Master XL-60 system in order to test Custom ICs on their processor board, differentiating between design and process problems.
International Microcircuits 3350 Scott Blvd. 8ldg. 37 Santa Clara, CA 95054 (408) 727-2280	Rockwell	\$2.75 million	To manufacture and supply gate arrays for use in the GPS program which will have 24 satellites in orbit.
Interstate Electronics 1001 E. Ball Rd. P.O. Box 3117 Anaheim, CA 92803 (714) 635-7210	Elgin Air Force Base	\$25.5 million	To develop Translator Processing Systems (TPS) for use in tracking test vehicles for an SDI program.
Link Flight Simulation 1 Corporate Drive Kirkwood, N.Y. 13902 (607) 721-6127	U.S. Army	\$60 million	To supply an MH-47E Combat Mission Simulator for the army's special operations forces.
Micralag 20270 Goldenrod Lane Germantown, MD 20874 (301) 428-3227	U.S. Department of Justice, Immigration, and Naturalization Service	\$1 million	To install multi-line, voice-messaging systems.
Natel Engineering 4550 Runway St. Simi Valley, CA 93063 (805) 581-3950	Ocean Technology	\$2 million	To manufacture synchro conversion components for use in the Navy's Mork 53 Update Combat Console.
Picturetel One Intercontinental Way Peabody, MA 01960 (617) 535-7700	Kyocera	\$2 million	To manufacture and supply the C-3000 videoconferencing system to this Japanese based company.
Precision Standard Time 105 Fourier Ave. Fremont, CA 94539 (415) 656-4447	Los Angeles County	\$2 million	To synchronize traffic signals, allowing motorists traveling at the speed limit to hit fewer red lights.
Protek Environmental 15243 Springdale Ave. Huntington Beach, CA 92649 (714) 897-0781	Equitable Life Insurance	Not disclosed	To treat oil- and diesel-contaminated soil on property owned by Equitable. Protek uses advanced biocultures for on-site toxic clean-up.
Sage Software/Perot 3200 Monroe St. Rockville, MD 20852 (301) 230-3200	Los Alamos National Laboratory	\$250,000	To license APS Development Center products and to provide support and training services.
Sanders/GE Daniel Webster Hwy South Nashua, NH 03061 (603) 885-2816	Wright Patterson AFB	\$70 million	To create the Integrated Warfare System which will be used on the Air Force Advanced Tactical Fighter and the Navy A-12.



## CONTRACTS AWARDED

AWARDED TO	AWARDED BY	AMOUNT	PURPOSE
<b>Sequoia</b> 3 Metropolitan Corporate Cr. Marlborough, MA 01752 (508) 480-0800	FAA	\$11 million	To manufacture computers for the FAA's Weather Communications Processor systems.
<b>Siemens Energy &amp; Automation</b> P.D. Box 89000 Atlanta, GA 30356 (404) 393-8200	Alcoa	Not available	To modernize and install cycloconverters in a continuous hot-strip rolling mill in Alcoa, Tenn.
<b>Salarex</b> 1335 Piccard Dr. Rockville, MD 20850 (301) 948-0202	United Nations	Not disclosed	To supply a 50 kilowatt sun-powered electric-generating plant to a remote village in Pakistan as part of a U.N. development project.
<b>Spire</b> Patriots Park Bedford, MA 01730 (617) 275-6000	Department of Energy	Not disclosed	To conduct polymer ion-implantation research.
<b>Symbol Technologies</b> 116 Wilbur Pl. Bahemia, NY 11716 (516) 563-2400	Grace Brothers British Post Office	\$2 million	To provide point-of-sale (POS) bar code scanning systems. Symbol received two separate contracts from Grace Bros. in Australia and the British Post Office.
<b>Tandem Inc.</b> 19333 Valico Pkwy. Cupertino, CA 95014 (408) 725-6000	FAA	\$61 million	To supply Tandem NonStop computer and communications equipment for monitoring navigation and radar systems for use by military and commercial pilots.
<b>Tydac Technologies</b> Arlington, VA (703) 522-0773	National Oceanic and Atmospheric Administration	\$195,000	To provide SPAN5 geographic information systems.
<b>Unisys</b> P.O. Box 500 Blue Bell, PA 19424 (703) 556-5302	Department of Labor	Not disclosed	To provide UNIX based sequent parallel systems, Informix relational base product suite, and peripheral devices to replace obsolete systems.

## RESEARCH REPORTS

STUDY BY	TITLE	FORECAST	PRICE
<b>Battelle</b> 505 King Ave. Columbus, OH 43201 (614) 424-4717	Plasma Technology for Surface Modification	Evaluates research activity and future prospects in plasma technology for industrial applications.	\$8,000
<b>Datapro</b> 1805 Underwood Blvd. Delran, NJ 08075 (800) 328-2776, ext. 2203	Numerical Control Overview	Details of the operational and technical features of computer numerical-control systems.	\$35
<b>The Freedonia Group</b> 20600 Chagrin Blvd. Cleveland, OH 44122 (216) 921-6800	Anti-Friction Bearings (# 855)	Anti-friction bearing shipments should have an annual increase of 3.5%, reaching \$4.1 billion in 1992.	\$800
<b>The Freedonia Group</b> 20600 Chagrin Blvd. Cleveland, OH 44122 (216) 921-6800	Strapping and Film Wrap (# 851)	Strapping and film wrap demand should increase 6% annually through 1992, reaching 1.5 billion pounds.	\$800

## RESEARCH REPORTS

STUDY BY	TITLE	FORECAST	PRICE
Frost & Sullivan 106 Fulton St. New York, NY 10038 (212) 233-1080	Distributed Control Systems Market in Europe (# E932)	Distributed control systems market should increase from \$1.3 billion in 1987 to \$1.8 billion in 1992.	\$3,000
Frost & Sullivan 106 Fulton St. New York, NY 10038 (212) 233-1080	The Home TVRO/D85 Market in The U.S. 1988-1993 (# A1895)	Annual sales revenue should increase from \$805 million in 1988 to \$4.7 billion in 1993.	\$2,100
Frost & Sullivan 106 Fulton St. New York, NY 10038 (212) 233-1080	Uninterruptible Power Supplies (UPS) and Power Conditioning Equipment in Europe (# E1054)	Consumption should increase from \$590 million in 1987 to \$859 million in 1992.	\$3,000
Frost & Sullivan 106 Fulton St. New York, NY 10038 (212) 233-1080	The U.S. Market for Local Area Networks in The Factory (# A1868)	The LANs market should have on 11% to 15% compound annual growth during the 1988 to 1992 period, to reach \$133 to \$159 million by 1992.	\$2,150
Frost & Sullivan 106 Fulton St. New York, NY 10038 (212) 233-1080	U.S. Military Semiconductor Market (# A1878)	The electronic training and simulation market should increase from \$130 million in 1987 to \$265 million in 1992.	\$2,100
Future Computing/Datapro 8111 LBJ Highway Dallas, TX (800) 328-2776	Peripherals Forecast 1988	Projects 1988-93 PC peripheral sales, with 1988 sales growing almost 18 percent.	\$2,000
Marketshare 21 Cochituate Rd. Wayland, MA 01778 (508) 358-2154	License Servers: New Pricing and Marketing Possibilities for LAN Software	Identifies marketing issues introduced with flexible licensing technology. Offers strategies to software, hardware, and systems vendors.	\$5,000
Jetro c/o Want Publishing 1511 K St. N.W. Washington, DC 20005 (202) 783-1887	Japan's Machinery Market	Examines prospects for exporting high tech machinery products to Japan, and identifies technologies of interest to the Japanese.	\$148
Arthur D. Little Decision Resources 17 New England Executive Park Burlington, MA 01803 (617) 270-1222	The Outlook for the Information Processing Industry: Global Strategies in the 1990s	Information on the status, trends, breakthroughs, and opportunities in the industry.	\$1,800
Newton-Evans Research 3220 Corporate Court Ellicott, MD 21043 (301) 465-7316	Computer Usage Trends Among Large Industrial Services Companies	Reports on the role of information systems among the leading industrial services companies in the United States.	\$495
Schonfeld & Associates 2530 Crawford Ave. Evanston, IL 60201 (312) 869-5556	R&D Ratios & Budgets	Presents estimated 1988 R&D budgets, forecasts for 1989, as well as R&D-to-sales ratio and R&D-to-gross margin ratio for 1988 for over 2,500 companies.	\$295
Technical Insights P.O. Box 1304 Fort Lee, NJ 07024 (201) 568-4744	Advanced Materials: 21 Market Forecasts For Key Product Areas	Analyses of growth and potential development in nine areas of advanced materials.	\$325
The Yankee Group 200 Portland St. Boston, MA 02114 (617) 367-1000	CASE: Promise and Problems of New Tools	There should be an increase of 26% within 5 years of MIS professionals using CASE.	\$2,500



## ACQUISITIONS

BUYER	BUSINESS	COMPANY ACQUIRED	BUSINESS	AMOUNT
ARC Electronic Associates 905 Bassett Rd. Westlake, OH 44145 (216) 835-8400	Integrates telecommunications systems.	Data World Networking 12006 98th St. N.E. Kirkland, WA 98034	Specializes in data communications systems integrations.	Not disclosed
Atlantic Computer 600 Third Ave. New York, NY 10017 (212) 983-9666	Supplies and finances IBM and DEC computer systems.	Datasease 5 Sylvan Rd. South Westport, CT 06880	Leases IBM, DEC and Wang mid-range computer systems.	Not disclosed
Chiron Ophthalmics 15A Marconi Irvine, CA 92714 (714) 768-469D	Develops wound-healing agents and refractive surgery products.	Aurora Biologicals P.O. Box 587 Williamsville, NY 14221 (716) 688-8491	Markets the fluid used by eye banks to stare cataracts.	Not disclosed
Computer Associates International 711 Stewart Ave. Garden City, NY 11530 (516) 227-3300	Develops, markets and supports applications and systems software products.	Applied Data Research 206 Orchard Rd. Princeton, NJ 08543 (609) 921-3070	Develops and markets software products for database management and application-development systems.	\$170 million
Hawmet Corp. 475 Steamboat Rd. Greenwich, CT 06836 (203) 661-4600	Produces precision casting for aircraft turbine engines.	Tempcraft 3960 South Marginal Rd. Cleveland, OH 44114 (216) 391-3885	Produces equipment and products for aircraft engine programs.	Not disclosed
NCS 11000 Prairie Lakes Dr. P.O. Box 9365 Minneapolis, MN 55440 (612) 829-3000	Manufactures, markets and distributes scanning and computer equipment and service.	Greystone Technology 8 Lakeside Office Park Wakefield, MA 01880 (617) 246-0461	Develops and markets Mumps system software and productivity products.	Not disclosed
Sun Microsystems 2550 Garcia Ave. Mountain View, CA 94043 (415) 960-1300	Supplies network-based distributed computing systems.	Folia 100 View St. Mountain View, CA 94042 (415) 969-9760	Develops and sells typographic and imaging technologies for use in electronic publishing.	Not disclosed

## JOINT VENTURES

COMPANY	COMPANY	PURPOSE	CONTACT
Ball	Onex	To form Ball-Onex Packaging in Canada, to manufacture metal packaging.	Ball 345 South High St. Muncie, ID 47305 (317) 747-6170
Canoca Specialty Products	Petroferm	To form Hydraflow Technologies Ltd., to develop and market products and technologies for production, transportation, and combustion of viscous hydrocarbons.	CSPI P.O. Box 2197 Houston, TX 77252 (713) 293-1043
Genesis Pharmaceuticals	KabiVitrum AB	To develop Genesis products for the European market and to fund research on purine/pyrimidine technology as a treatment for certain diseases.	Genesis Pharmaceuticals 11075 Roselle St. San Diego, CA 92121 (619) 546-8300
Invitran	SmithKline Beckman	Invitran will manufacture soluble T <sub>4</sub> , a potential therapy against AIDS, and other biopharmaceutical products for SmithKline Beckman.	Invitran 4649 Le Baurget Dr. St. Louis, MO 63134 (314) 426-5000

# New Products

## ■ OFFICE PRODUCTS

**Model 24 Ektaprint 1392 printer.** Compatible with the PostScript page-description language. The printer produces 92 pages/minute of complex graphics, graytones and type fonts. It uses a light bar to print on cut paper at a resolution of 300 dots/inch. Includes 18 megabytes of random-access memory. The printer also accepts print files from other applications and platforms. \$190,000. Eastman Kodak Co., 343 State St., Rochester, NY 14650. (716) 724-1336. *Circle 1.*

**EZ45B/46B typewriters.** Model EZ45B has a two-line correction memory, automatic centering and various print-spacing settings; it prints 20 characters/second. The EZ46B has a 40-character liquid-crystal display, an eight-kilobyte memory and features search, search and replace and stop codes. \$326 and \$382, respectively. Silver Reed Inc., 19600 South Vermont Ave., Torrance, CA 90502. (800) 346-3966, ext. 540. *Circle 2.*

**Model 40/80 word processor.** For small offices and at-home use. Model 40 has an 80-character×8-line display and 42,000 characters of internal memory. Model 80 has an 80-character×16-line flip-up display, 50,000 characters of internal memory and a disk drive. Both include Word-Right, AutoSpell, Spell-Right Dictionary, WordEraser, Word-Find and List Feature software. \$749 for Model 80; \$599 for Model 40. Smith Corona, 65 Locust Ave., New Canaan, CT 06840. (203) 972-1471. *Circle 3.*

**Videowriter 4500 word processor.** Combines word processing, chart making and communications through an external modem. The unit has an RS-232C communications port and offers mail merging, a thesaurus, spell checking, a split screen, disk copying and block moving. Handles 80-column documents. \$999; sold under the Mag-navox name. Philips Consumer Electronics Company, Box 14810, Knoxville, TN 37914. (615) 521-4316. *Circle 4.*

## ■ COMMERCIAL/INDUSTRIAL

**3865X microprocessor.** Supports 32-bit software. Works with industry-standard operating systems, including MS-DOS, OS/2, Unix, and Xenix and has a 16-bit external data bus. \$165. Intel Corp., 3065 Bowers

Ave., Santa Clara, CA 95052. (800) 548-4725. *Circle 5.*

**Datapath 4D disk duplicator.** Allows users to format, copy, and verify eight 5¼ or 3½-inch disks at one time. The system makes 480 copies an hour, taking up one personal-computer slot for each four drives. Available in four- or eight-drive configurations. Includes menu-driven software with on-screen status summaries. 1,995. Datapath Technologies Inc., 46710 Fremont Blvd., Fremont, CA 94538. (415) 651-5580. *Circle 6.*

**ITC5750 switch-time tester.** Evaluates n-channel or p-channel devices with a 10-volt adjustable gate drive supply; can work with plug-in resistors. The device runs off 110 or 220 volts AC and has a metal enclosure for static protection. \$550. Integrated Technology Corp., 1228 North Stadem Dr., Tempe, AZ 85281. (602) 968-3459. *Circle 7.*

**Motorola Data Disk program.** An IBM-compatible program that helps design engineers select the best radio-frequency devices for their applications. The software lists more than 7,000 devices, 20,000 cross references, and 130,000 parameters. It also offers 58 product categories for more than 6,500 devices. Users enter a device number to access information; the program lists the best device first. Price not available. CyberSoft Inc., 440 East Harmony Ave., Mesa, AZ 85204. (602) 962-0075. *Circle 8.*

**Series 80 multimeters.** Three models made for field service and plant maintenance. All handle frequency, duty cycle, capacitance, and simultaneous minimum/maximum recording. The analog display, which is updated 40 times/second, is a high-resolution pointer on Model 87 and a bar graph with zoom mode on Models 83 and 85. All models offer overload protection to 1,000 volts. \$189 for Model 83, \$219 for Model 85, and \$259 for Model 87. John Fluke Manufacturing Co. Inc., Box C9090, Everett, WA 98206. (800) 443-5853; in Wash., (206) 347-6100. *Circle 9.*

## ■ COMPUTER HARDWARE

**Advansys design-entry system.** A workstation that includes a schematic editor, design compilers, a basic component library and packaging/reporting programs to pre-

pare designs for printed-circuit boards. The system includes a 20-megaHertz Sun 386i/150, eight megabytes of random-access memory, a 155-megabyte hard disk and a 19-inch monochrome monitor. \$23,000. Daisy Systems Corp., 700 E. Middlefield Rd., Mountain View, CA 94043. (415) 960-6591. *Circle 10.*

**Artist RealVision display controller.** Comes in two versions: Model 24 and 16. Both are enhancement boards compatible with TIPS, RIO, TOPAS, Lumena, Crystal 3-D, AutoCAD, AutoShade, and Mirage software. They produce noninterlaced images and offer double buffering, plus support for NTSC and PAL. \$4,295 and \$3,595, respectively. Control Systems, 2675 Patton Rd., Saint Paul, MN 55113. (612) 631-7800. *Circle 11.*

**LS-300AM Microchannel adapter.** Interfaces with Princeton Graphics' LS-300 desktop high-resolution image scanner with IBM PS/2 Models 50 through 80 and compatible computers. The adapter offers block data transfer for faster input, plus reverse imaging from hardware bit polarity. Installs without hardware jumpers or switch setting. \$350. Princeton Graphics Systems, 601 Ewing St., Building A, Princeton, NJ 08540. (609) 683-1660. *Circle 12.*

**MC-II hand-held computer.** This tiny 1.3-pound computer has 128 kilobytes of random-access memory that expands to one megabyte, plus an 8-line×21-character display. The computer is programmable and compatible with MBase-dBase III Plus, Microsoft C, MC-Basic and 41M software. Has two RS-232C ports and a Kermit file-transfer protocol; supports bar-code scanning and smart wands. \$750. CMT Inc., 895 Northwest Grant Ave., Corvallis, OR 97330. (503) 752-5456. *Circle 13.*

**Model 25 digital signal processor.** An IBM PC/XT/AT-compatible board designed for engineering applications. Includes a 40-megaHertz Texas Instruments TMS320C25 digital signal processor and 12-bit, 110-kiloHertz analog/digital and digital/analog converters. \$1,195. Dalanco Spry, 2900 Connecticut Avenue N.W., Suite 241, Washington, DC 20008. (202) 232-7999. *Circle 14.*

**Powermate 1 Plus computer.** A personal computer based on the 80286 microprocessor. The system has a 12-megaHertz clock speed with no wait-states and offers as much



as 16 megabytes of random-access memory. The basic unit includes 640 kilobytes of memory, a 5¼- or 3½-inch floppy disk drive and a 42-megabyte hard drive. \$3,595. NEC Information Systems Inc., 1414 Massachusetts Ave., Boxborough, MA 01719. (800) 343-4418; in Mass., (508) 264-8000. *Circle 15.*

**Z-248/12 and Z-286 LP computers.** Both models operate with no wait-states. The high-end Z-248/12 has a 12-megaHertz real-time clock speed and comes in five versions with a variety of disk drives. \$2,999 to \$6,799. The portable, 17-pound Z-286 LP comes with a 40-megabyte hard disk drive and a 1.44-megabyte floppy drive. \$3,999. Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025. (800) 842-9000. *Circle 16.*

**Design Analysis System.** Equipped with a design-entry package, the system edits waveforms and has network-access tools for performing logic simulation on remote accelerators. Includes the Sun 386i/150 with eight megabytes of random-access memory, 32 kilobytes of static cache memory, a 155-megabyte hard disk and a 16-inch color monitor. \$38,000. Daisy Systems Corp., 700 E. Middlefield Rd., Mountain View, CA 94043. (415) 960-6591. *Circle 17.*

**FX/80T TEMPEST mini-supercomputer.** Provides supercomputing power and parallel processing for classified defense, intelligence and commercial projects. \$449,000. Alliant Computer Systems Corp., 1 Monarch Dr., Littleton, MA 01460. (800) 622-1113; in Mass., (508) 486-4950. *Circle 18.*

**MicroControl security system.** Protects system resources and files on Wang PC 200/300 computers. The security system consists of an option card, two electronic tokens, a token reader and software to control access and prevent tampering. Handles as many as 64 users. \$1,200. Wang Laboratories Inc., 1 Industrial Ave., Lowell, MA 01851. (508) 459-5000. *Circle 19.*

**SunLink CG3270 terminal emulator.** Gives Sun workstation users access to IBM host mainframe applications, including those involving color and graphics. The board offers dynamic scaling of displayed images, multiple terminal sessions per workstation and local display manipulation. \$950. Sun Microsystems Inc., 2550 Garcia Ave., Mountain View, CA 94043. (800) 821-4643; in Calif., (800) 821-4642. *Circle 20.*

## ■ CONSUMER PRODUCTS

**CA-2000E integrated amplifier.** Offers 100 watts of continuous power per channel. The amp has an infrasonic filter for clean bass reproduction, five line inputs and a remote-control handset to adjust volume, mute signals and switch sources. \$799. Audio Dynamics Corp., 851 Traeger Ave., San Bruno, CA 94066. (800) 541-5696; in Calif., (415) 266-8550. *Circle 21.*

**CBM-3000 portable CD player.** This compact-disc player provides 16-selection random-access programming, double oversampling/filtering, a three-beam laser head and a 16-bit digital/analog converter. Anti-shock circuitry protects the player from bumps and jolts. Includes a jack for an optional remote sensor and programmable controls for memory enter/repeat/keylock. A 10-button keypad allows manual operation of remote controls. From \$329.95. CBM America Corp., 2999 Overland Ave., Los Angeles, CA 90064. (800) 421-6516. *Circle 22.*

**CD-2000E compact-disc player.** Has a three-beam laser pickup, 16-track programmability and linear 16-bit digital/analog conversion with quadruple oversampling. The unit includes remote control and plays small CD singles without an adapter. \$399. Audio Dynamics Corp., 851 Traeger Ave., San Bruno, CA 94066. (800) 541-5696; in Calif., (415) 266-8550. *Circle 23.*

**CX-800U/600U preamplifiers.** Two models, each controlled by an infrared remote-control switch. The CX-800U handles eight input sources, including record output for four audio and two video sources. Model CX-600U has six input sources, including two audio record outputs and a video output for a videocassette recorder. Both models come with a 28-key infrared remote controller. \$699 and \$499, respectively. Yamaha Electronics Corp., 6660 Orangethorpe Ave., Buena Park, CA 90620. (800) 492-6242. *Circle 24.*

**Ensemble stereo speaker system.** Includes two low-frequency units and two upper-range "satellite" units. The low-frequency units have eight-inch acoustic suspension drivers, 12 decibels per octave, with system resonance of 54 Hertz. Upper-range units have 3½-inch cone drivers surrounded by fabric, 12 decibels per octave and 1¼-inch direct radiator tweeters. \$499. Cambridge Sound Works, 154 California St., Newton, MA 02158. (617) 332-9461. *Circle 25.*

**Identadisc CD labeler.** Uses a thermal process with a custom die to stamp compact discs with initials. The stamp creates a permanent mark on the inner ring around the disc's center hole. The process does not affect the quality or longevity of the disc, according to the company. \$49.95 (introductory price). Hi-Pro-Tech, Box 1357, Lansdale, PA 19446. (215) 822-2114. *Circle 26.*

**Model CPJ815 camcorder.** Has an automatic image stabilizer that helps eliminate jitters caused by walking or riding in a vehicle. Also has a flying erase head, a three-position high-speed shutter, low-light sensitivity and VHS index and address search. Offers power zoom, a ⅜-inch black-and-white electric viewfinder, audio/video dubbing, automatic date with memory, automatic white balance and indoor/outdoor switching. \$2,699. Philips Consumer Electronics Co., I-40 and Straw Plains Pike, Box 14810, Knoxville, TN 67914. (615) 521-4499. *Circle 27.*

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# Electronic Constant Companion

## LEISURE

### The Wizard helps manage time and info

**T**HE JAPANESE are buying them at the rate of over 100,000 a month. But will business and professional people in other nations take to the Wizard, an electronic time-and-information manager the size of a cigar case?

Sharp Electronics, Mahwah, N.J., has just introduced specially designed versions of its electronic constant companion in the United States, the United Kingdom, Germany and Canada. It sells in America for \$300, plus from \$100 to \$130 for the various "IC cards" that add such functions as language translation—into eight others, no less—spellchecker/thesaurus and expense management to its seven basic, built-in functions: calendar, schedule, phone/address book, memo pad, local time, world clock (local time in 212 cities) and calculator. In addition, memos that appear on the up-to-eight-line display can be printed out on a small printer that costs \$170. The contents of the memo pad can also be transferred to a desktop or laptop computer via cable.

The Wizard, which is touted as "easy to learn to use," comes with a 200-page instruction manual that's bigger than the device. The manual is not needed to figure out how to use most of



Sharp's Wizard comes with cards that add functions.

the basic functions, but essential for less-common functions, such as entering and retrieving confidential data. Entering data on the alphabetically arranged keyboard is slow for those accustomed to the conventional "qwerty" keyboard.

Many of the Wizard's functions have been available in mostly smaller and thinner (it's one-half inch thick) devices. For example, five years ago Seiko introduced its Date-2000 digital watch with a 4,000-character memory; the Wizard can store 32,000 characters. The problem with the Seiko watch was that when the battery died after about a year, the volatile memory was wiped blank. The Wizard overcomes this deficiency with a backup battery; the main battery is supposed to last two years. Like most digital watches, the Wizard

includes alarms—two of them—one for morning wakeup and the second to remind of important appointments.

Specialized electronic spelling checkers and thesauri are available in a variety of forms. For example, Franklin Computer's line ranges from \$70 for its 5 x 3 x 5/8-inch Pocket Spelling Ace to \$300 for its desktop Language Master LM-200, which also indicates hyphenation points. The Pennsauken, N.J.-based manufacturer also offers a pocket spellchecker/thesaurus for \$130. A competing device, the WordFinder from Selectronics, offers both an A-to-Z and a Qwerty keyboard. Listed at \$119, but heavily discounted like all such gadgets, the WordFinder is reportedly selling at the rate

of 50,000 a month in the U.S.

There is one feature the Wizard offers that is apparently unique: a password function that permits the user to enter confidential memos, such as one's Swiss bank-account number.

One function the Wizard does not offer is measurement. Last year, ultrasonic tape measures appeared that can measure the distance to nearby points. The latest such gadget—available in hardware stores—is from Sonin, Inc., White Plains, N.Y. It can also calculate square feet and cubic feet. There are four models that can measure to points ranging from 30 feet to 250 feet away with an accuracy to within one-half inch. They cost from \$100 to \$150 each.

Potential users were shown the Wizard in an informal survey. They were asked how much they would be willing to pay for it. The half-dozen prices voiced ranged from a low of \$50 to a lone executive who mentioned a price above \$100. His price was \$200—except that he wouldn't buy one.

Based on the great success of the Wizard since it was introduced in Japan last year, one can expect lower-priced knockoffs from competitors. If they don't attempt to match all the functions of the Wizard, they should be smaller and weigh less than the original's 8.5 ounces. That would be an advantage for the top executives the device is aimed at, especially those who already carry cigar cases.

—Mel Mandell



Confidential memos can be entered into the Wizard.



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